

BIOLOGICAL INTEGRITY OF FOUR FLATHEAD VALLEY STREAMS

Prepared for:

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Summary

Between 1984 and 1994, monitoring was conducted on Ashley Creek, East Spring Creek, the Stillwater River and the Whitefish River to assess biological and water quality changes brought on by population growth, land use changes, and pollution controls.

Total ammonia and total phosphorus declined dramatically in Ashley Creek following installation of advanced treatment at the Kalispell WWTP and passage of a phosphate detergent ban in Flathead County. Even with this improvement in water quality, biological integrity in Ashley Creek worsened because of the significantly larger volume of treated wastewater discharged by the Kalispell plant after it accepted Evergreen community sewage in 1994. Biological integrity in Ashley Creek also declined at a sampling station upstream from the Kalispell WWTP, presumably because of increased nonpoint source pollution.

Biological integrity in East Spring Creek rated "good" to "excellent" in reaches that have been rehabilitated by the Flathead Conservation District. The site below Farrier's Dam had "poor" biological integrity because of solar heating of ponded water behind the dam.

On November 30, 1994, nitrate nitrogen concentrations in the Stillwater River increased six-fold between Logan Creek and Kalispell. This decline in water quality was accompanied by a decline in biological integrity from "excellent" to "good". Nonpoint sources of pollution were responsible for this decline.

The discharge from the Whitefish WWTP was found to impair biological integrity in the Whitefish River, even after phosphorus removal and the phosphate detergent ban. Impairment was somewhat greater in 1994 than in 1992; perhaps because of a larger volume of discharge in 1994 (due to additional sewer hookups) and the several bypasses of the treatment system that occurred between 1992 and 1994. Biological integrity improved somewhat between Highway 40 and Evergreen. This improvement may represent recovery from the residual effects of the Whitefish WWTP discharge.

Nutrient controls that have been implemented to protect Flathead Lake from accelerating eutrophication have been only partly successful at restoring the biological integrity of Flathead Valley streams. Potential ecological improvements to be realized by advanced wastewater treatment at the Kalispell and Whitefish WWTPs have been offset by the larger volumes of wastewater that are now being treated and discharged by these facilities. Intermittent bypasses of the treatment system at the Whitefish WWTP may have also contributed to biological impairment in the Whitefish River.

Although significant water quality improvement has been documented in East Spring Creek, nonpoint source pollution continues to degrade Ashley Creek, the Stillwater River, and other streams in the Flathead Valley.

Introduction

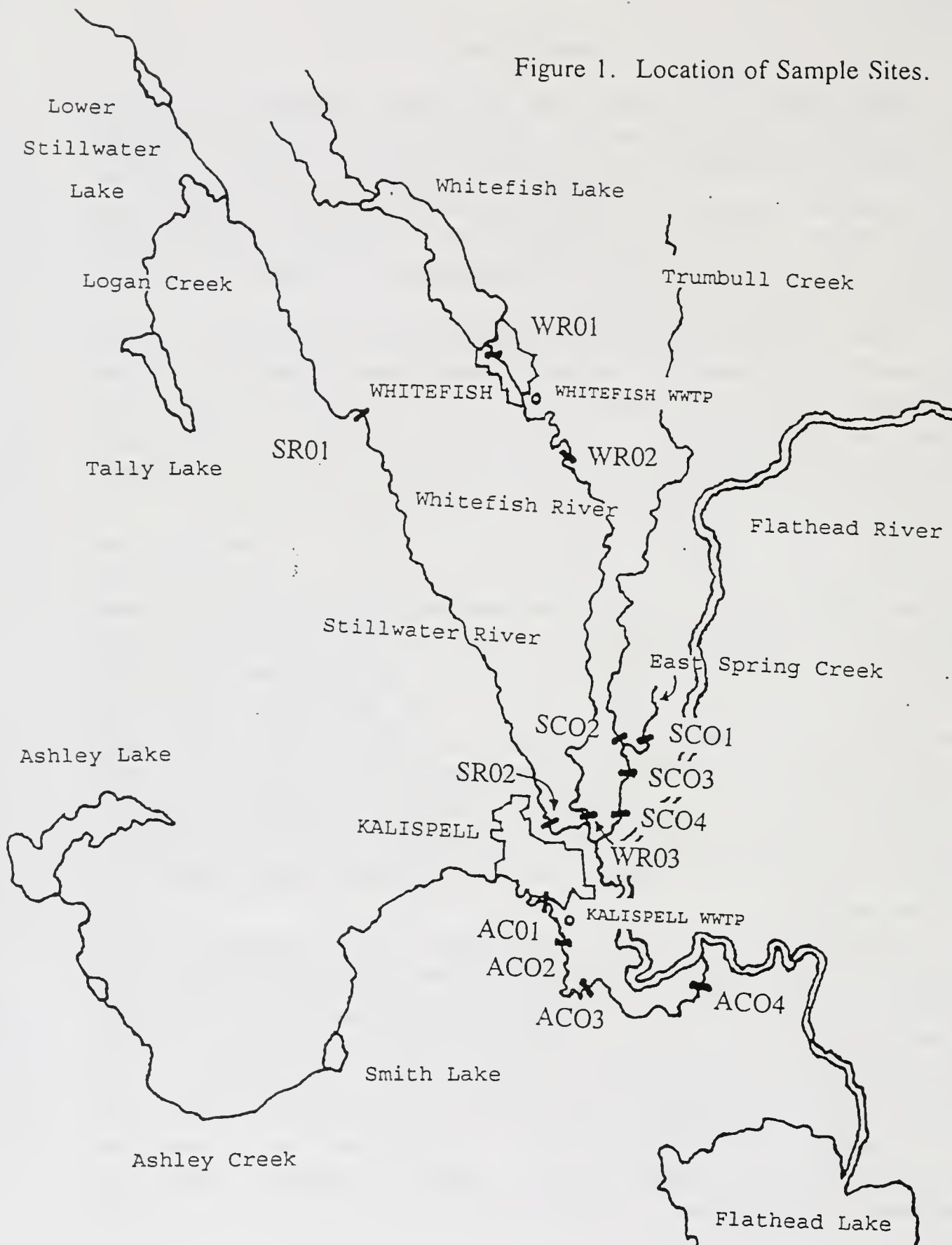
This report evaluates the biological integrity of four Flathead Valley streams that have experienced water quality changes in recent years brought on by population growth, land use changes, and pollution controls. These four streams--Ashley Creek, East Spring Creek, the Stillwater River and the Whitefish River--are tributaries of the Flathead River upstream from Flathead Lake in northwestern Montana (Figure 1).

These streams head in forested and agricultural lands of rural Flathead County, Montana. In their lower reaches, near the City of Kalispell, they flow through areas that are experiencing rapid growth and suburbanization. In 1994 about 1,600 new residents were arriving in Flathead County each year and the estimated population of the county was 66,000 (Flathead Basin Commission 1994).

These four streams, along with 26 other streams in the Flathead Basin, are on the latest list of impaired waterbodies in Montana (MDHES 1994). Ashley Creek and East Spring Creek have been impaired by nonpoint sources of pollution, and a rehabilitation project was recently completed on East Spring Creek (Flathead Conservation District 1987, 1992). The Kalispell Wastewater Treatment Plant (WWTP), which discharges to Ashley Creek, was recently upgraded to remove both phosphorus and nitrogen from the wastewater stream. A county ban on the sale and distribution of phosphate detergents in 1986 also helped to reduce phosphorus loading to Ashley Creek and to other Flathead County ground and surface waters.

Beginning in July 1994, wastewater from Evergreen began flowing to the Kalispell WWTP through a newly constructed sewer and collector system. Until then, Evergreen had been Montana's largest unsewered community. The transfer of Evergreen wastewater to the Kalispell facility was done in stages over several months. By December 1994, wastewater from about 1900 Evergreen hookups was being piped to the Kalispell plant. Adding service to Evergreen increased flows through the Kalispell treatment plant and wastewater discharges to Ashley Creek from about 1.5 million

Figure 1. Location of Sample Sites.



gallons per day to about 2.0 mgd (Joni Emrick, Kalispell WWTP Manager, 12/29/95).

Physical encroachment into riparian zones and increased nutrient loading to groundwater from on-site sewage disposal systems have degraded East Spring Creek and threaten the lower reaches of the Stillwater and Whitefish Rivers. The Whitefish River also receives effluent from the Whitefish Wastewater Treatment Plant. This plant provides basic treatment and removes phosphorus from the wastewater, but treatment is sometimes bypassed when the plant is overloaded with stormwater. The Whitefish area is experiencing rapid growth and the treatment plant has accepted additional wastewater in recent years from four adjacent developed areas (Scott Anderson, DEQ/WQD, 11/17/95). The Whitefish WWTP accounts for almost half the total phosphorus load from Flathead Valley sewage treatment plants (Flathead Basin Commission 1994).

The Flathead County phosphate detergent ban and nutrient removal by the Kalispell and Whitefish WWTPs were key elements of the Montana Department of Health and Environmental Sciences' 1984 "Strategy for Limiting Phosphorus in Flathead Lake" (MDHES 1984).

Biological Integrity

Biological integrity is defined as "the ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitats of a region" (Karr and Dudley 1981). Upstream control sites or least-impaired streams in the same ecoregion are used as the benchmarks ("natural habitats") for assessing the biological integrity of study streams.

The biological group used for this assessment is the diatom association within the periphyton community. Periphyton is the community of small plants, animals and microbes that live attached to or in close proximity of the stream bottom. Algae are the primary producers in periphyton communities. Diatoms are mostly microscopic, olive-colored algae that are distinguished from other kinds of algae by ornamented cell walls that are impregnated with

silica. Diatoms account for much of the biological diversity and primary productivity in Montana streams.

Sampling Sites and Schedule

Thirteen sample sites were established on the four streams (Table 1 and Figure 1). The sites were selected to bracket the effluents of municipal wastewater treatment plants (Ashley Creek and Whitefish River), a stream rehabilitation project (East Spring Creek), and areas of agriculture and rapid subdivision development (Stillwater River and Whitefish River). Downstream sites on Ashley Creek (AC03 and AC04) were intended to document recovery from the residual effects of the Kalispell wastewater discharge.

Samples were collected at the Ashley Creek sites in August and November 1984, before the Kalispell plant was upgraded to remove nutrients, and again in August and November 1994, after the plant was upgraded. The 1984 samples also preceded the county-wide ban on the sale and distribution of detergents containing large amounts of phosphorus. Nitrogen and phosphorus loading to Ashley Creek declined after 1989 as a result of plant upgrades and the phosphate detergent ban (Stanford et al. 1995).

Samples from Ashley Creek in August 1994 were collected during the phased connection of Evergreen septic systems to the Kalispell WWTP. Samples from Ashley Creek in November 1994 were collected at a time when the Kalispell WWTP was receiving nearly all of the wastewater that would be delivered from the Evergreen area.

Samples were collected from the other streams in November 1992 (Whitefish River), August 1994 (East Spring Creek), and November 1994 (Stillwater River and Whitefish River) (Table 2). Sampling in 1992 and 1994 on the Whitefish River bracketed several bypasses of the Whitefish wastewater treatment system in 1993 and an increase of about 50,000 gallons per day in treated wastewater discharged to the river due to additional sewer hookups (MPDES Permit Files, Montana Department of Environmental Quality). Sampling on East Spring Creek followed completion of a stream rehabilitation project (Flathead Conservation District 1992).

Table 1. Description of sample sites.

Code	Location	Legal Description
AC01*	Ashley Creek above Kalispell WWTP at Airport Road	T28N R21W Sec.19
AC02	Ashley Creek below Kalispell WWTP at Cemetery Road	T28N R21W Sec.29
AC03	Ashley Creek at Highway 93	T28N R21W Sec.33
AC04	Ashley Creek at county road near Flathead River	T28N R21W Sec.36
SC01	[East] Spring Creek at Farrier's Dam	T29N R21W Sec.27
SC02*	Trumbull Creek near mouth	T29N R21W Sec.28
SC03	[East] Spring Creek at Granite View	T29N R21W Sec.34
SC04	[East] Spring Creek at Highway 35	T28N R21W Sec.03
SR01*	Stillwater River below Logan Creek and Stillwater Lakes	T31N R23W Sec.10
SR02	Stillwater River at Whitefish Stage Road (7th Ave. E.) in Kalispell	T28N R21W Sec.08
WR01*	Whitefish River below Whitefish Lake off Woodland Place in Whitefish	T31N R22W Sec.25
WR02	Whitefish River at Highway 40	T30N R21W Sec.16
WR03	Whitefish River off River Road in Evergreen	T28N R21W Sec.04

*Control or reference site

Table 2. Sample dates and environmental information collected.

Site	Sample Date(s)	Flow*	Commons	Nutrients	Periphyton
AC01	08/84	M	X	X	X
	11/84	M	X	X	X
	08/94	E	X	X	X
	11/94		X	X	X
AC02	08/84	E	X	X	X
	11/84		X	X	X
	08/94	E	X	X	X
	11/94		X	X	X
AC03	Same Dates and Environmental Information as Site AC02				
AC04	08/84	E	X	X	
	11/84		X	X	
	08/94		X	X	X
SC01	08/94		X		X
SC02	08/94		X		X
SC03	08/94		X		X
SC04	08/94		X		X
SR01	11/94		X	X	X
SR02	11/94		X	X	X
WR01	11/92		X	X	X
	11/94		X	X	X
WR02	11/92		X	X	X
	11/94		X	X	X
WR03	11/92		X	X	X
	11/94		X	X	X

*E = Estimated Flow
M = Measured Flow

Methods

Streamflow and Water Quality

The kinds of environmental data collected at each site are shown in Table 2. Streamflow was measured with a Marsh-McBirney Model 2100 Water Current Meter. Field water quality measurements were made with a Horiba U-10 Water Quality Checker. Water samples for laboratory analysis were collected in new polyethylene bottles and preserved following guidelines of the Environmental Protection Agency (USEPA 1988). These samples were analyzed by the Chemistry Laboratory Bureau of the Department of Health and Environmental Sciences following standard analytical procedures (USEPA 1983).

Periphyton

Composite periphyton samples were collected from natural substrates according to Procedure No. 6.2.2 in the Montana Water Quality Bureau's Field Procedures Manual (MDHES 1989). Periphyton samples were shipped to Philadelphia for processing and analysis by the Patrick Center for Environmental Research at the Academy of Natural Sciences. Except as explained below, periphyton processing and analysis followed "Periphyton Bioassessment Methods for Montana Streams" (Bahls 1993). This manual also explains the rationale for the metrics (indexes) and the biocriteria used for periphyton bioassessment.

The Montana periphyton manual (Bahls 1993) describes two bioassessment protocols: Protocol I, in which study site metrics are compared to metrics derived from least-impaired reference sites in the same ecoregion; and Protocol II, in which study site metrics are compared to metrics obtained from a local, least-impaired control site on the same stream. Protocol II is more sensitive than Protocol I. Both protocols were applied to the Flathead streams. The biocriteria used to apply these bioassessment protocols are presented in Appendix A as Table 10A (Protocol I) and Table 12 (Protocol II) from Bahls (1993).

Protocol I employs three indexes or metrics: (1) an index of diatom diversity (Shannon); (2) an index of pollution based on the

water pollution tolerances of common diatom species (Lange-Bertalot 1979); and (3) a siltation index based on the percent relative abundance of mobile diatoms in the sample. (Motile diatom taxa, primarily those in the genera *Navicula* and *Nitzschia*, have a competitive advantage in habitats with aggrading and unstable substrates of fine sediment.) Protocol II adds an index of diatom community similarity (Whittaker and Fairbanks 1958) between the upstream control site and the downstream study site(s).

One additional index was added for this bioassessment. A disturbance index was calculated as the percent relative abundance of the diatom *Achnanthes minutissima*. This diatom is a pioneer species whose numbers are often directly proportional to the amount of physical or chemical disturbance at a site in the days or weeks preceding sample collection (Peterson & Stevenson 1992).

While large numbers of *Achnanthes minutissima* may indicate either physical or chemical stress, large numbers of other taxa may indicate other kinds of stress, including nutrient enrichment, sedimentation, organic loading, and extremes of temperature and salinity. Regardless of which species dominates a diatom association, low species richness and diversity are good overall indicators of stress of all kinds.

Results and Discussion

Results of streamflow measurements, field water quality measurements and laboratory analyses of water samples are presented in Appendix B. Key chemical and biological data are presented in a series of tables and figures in the body of this report. Results will be discussed by stream in the order in which they appear in Table 1.

Ashley Creek

Total ammonia and total phosphorus concentrations in Ashley Creek below the Kalispell WWTP declined substantially between 1984 and 1994 (Figures 2 and 3). Ammonia is the primary source of toxicity in municipal wastewater and it is also an algae growth-stimulating nutrient. Phosphorus is the principal cause of

Figure 2.; Total Ammonia Concentrations in
Ashley Creek, 1984 and 1994.

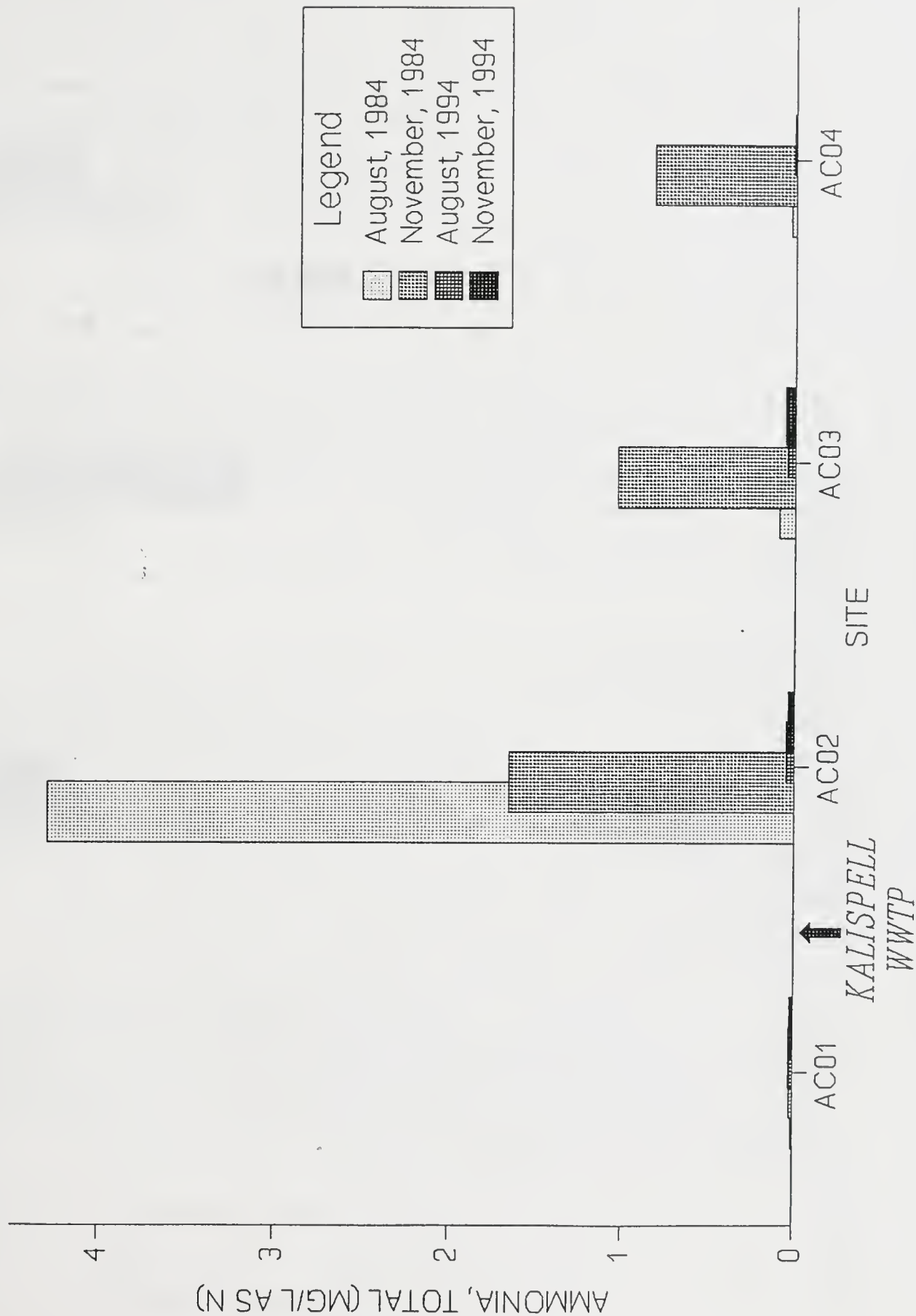
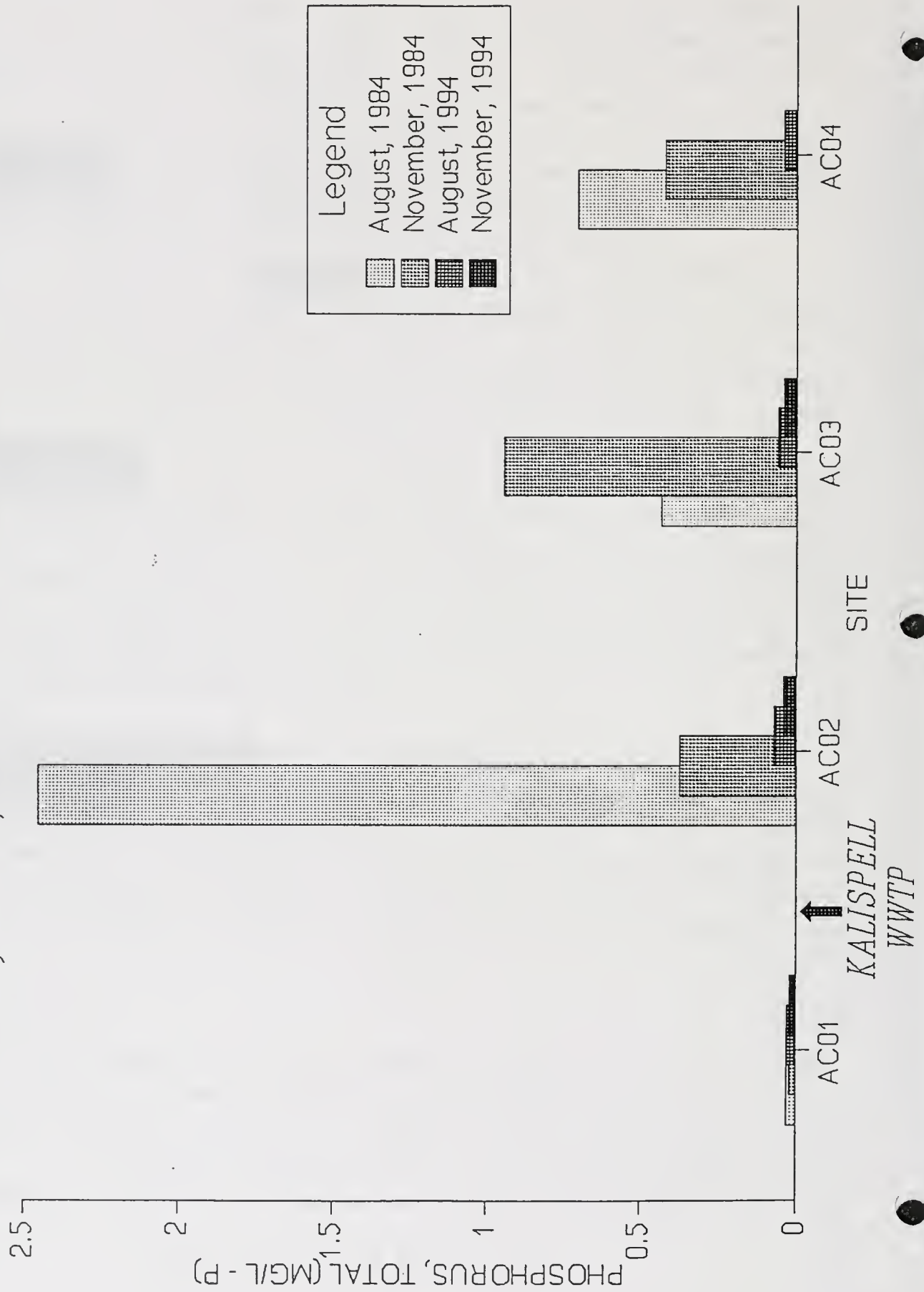


Figure 3. Total Phosphorus Concentrations in Ashley Creek, 1984 and 1994.



eutrophication in lakes, including Flathead Lake, and it is often the limiting nutrient for algal growth in streams.

Diatom diversity just below the Kalispell discharge declined in 1994 from levels measured at the same site (Cemetery Road) in 1984 (Figure 4 and Tables 3 and 4). Although the Kalispell effluent was of better quality in 1994, it was also larger in volume than it was in 1984 and accounted for a larger percentage of the flow in Ashley Creek (Joni Emrick, Kalispell WWTP Manager, 12/29/95). Increased dominance of Ashley Creek by the more thermally and chemically stable flows from the Kalispell treatment plant probably caused the observed decrease in diatom diversity.

Increased pollution index values at the Cemetery Road site (AC02) in 1994 reflect the improved water quality of Ashley Creek since 1984 (Figure 5 and Tables 3 and 4). For both the diversity index and the pollution index, a value of 2.50 (dashed horizontal line in Figures 4 and 5) is the threshold for impairment; values below this level generally indicate some degree of stress or water quality impairment for streams in the western part of Montana (Bahls 1993).

A small decline in the pollution index at the upstream site on Ashley Creek (Figure 5), coupled with a large increase in the siltation index (Tables 3 and 4), point to a decline in biological integrity at the Airport Road site (AC01) from 1984 to 1994. This decline was probably caused by an increase in nonpoint sources of pollution upstream from Kalispell (see Flathead Conservation District 1987). Bioassessment scores and ratings for Ashley Creek (Tables 5 and 6) confirm a decline in water quality at the Airport Road site from 1984 to 1994. Biological integrity at AC01 declined from "excellent" (August) and "good" (November) in 1984 to "good" (August) and "fair" (November) in 1994.

Based on August samples collected in 1984 and 1994, biological integrity below the Kalispell WWTP improved from "poor" to "fair", due primarily to a significant decline in the siltation index (Table 5). This trend was repeated from November 1984 to November 1994 using Protocol I and ecoregional reference conditions as the benchmark for comparison (Table 6).

Figure 4. Diatom Species Diversity in Ashley Creek, 1984 and 1994.

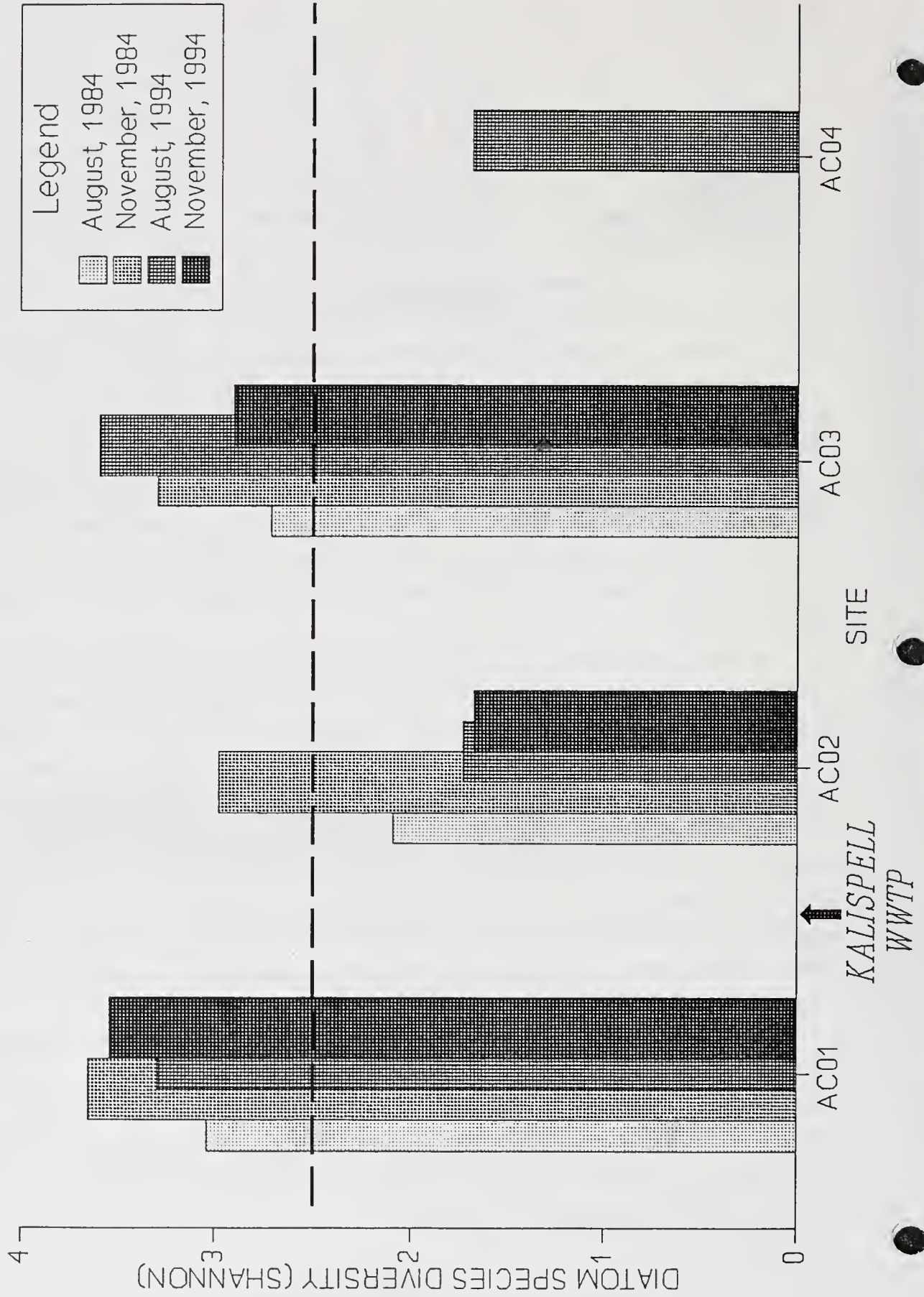


Table 3. Percent relative abundance of major diatom species and values of selected diatom metrics for periphyton samples collected from Ashley Creek in August 1984 and 1994.

Species/Metric*	AC01		AC02		Station AC03		AC04
	1984	1994	1984	1994	1984	1994	1994
<i>Achnanthes minutissima</i> (3)	7.0	9.3	0.3	14.7	0.6	7.5	23.3
<i>Amphora perpusilla</i> (3)	4.0	6.3		16.4	1.5	6.8	
<i>Cocconeis pediculus</i> (3)	7.8	0.3	1.9	2.9	11.3	2.0	
<i>Cocconeis placentula</i> (3)	21.7	20.4	0.8	1.0	55.8	11.7	0.4
<i>Cyclotella meneghiniana</i> (2)	0.8	0.1	16.4		1.1	0.8	0.5
<i>Cymbella affinis</i> (3)	0.3	10.1				0.3	
<i>Epithemia sorex</i> (3)	24.3	13.5		0.1		0.8	57.6
<i>Nitzschia kutzingiana</i> (2)	0.3	0.8	48.1	0.5	0.6	3.1	0.4
<i>Nitzschia palea</i> (1)		0.5	11.4		0.5	0.5	
<i>Nitzschia sicula</i> (1)		10.1				0.3	
<i>Rhoicosphenia curvata</i> (3)	2.8	0.9		53.3	3.4	14.6	0.4
Frustules Counted	400	400	400	400	400	400	400
Taxa Counted	39	45	25	19	50	47	25
Diversity Index (Shannon)	3.04	3.29	1.86	1.73	2.71	3.59	1.68
Percentage	100	100	61	53	89	109	51
Pollution Index	2.87	2.59	2.09	2.89	2.85	2.56	2.90
Percentage	100	100	73	112	99	99	112
Siltation Index	10.9	28.4	66.5	9.8	14.1	44.9	8.1
Percentage	100	100	16	290	77	63	351
Similarity Index	100	100	8.0	20.8	47.1	43.4	29.8

* The number in parentheses following the species name is the pollution tolerance class:

- 1 = Most tolerant of pollution
- 2 = Somewhat tolerant of pollution
- 3 = Sensitive to pollution

Table 4. Percent relative abundance of major diatom species and values of selected diatom metrics for periphyton samples collected from Ashley Creek in November 1984 and 1994.

Species/Metric*	AC01		Station AC02		AC03	
	1984	1994	1984	1994	1984	1994
<i>Cocconeis placentula</i> (3)	17.9	8.4	0.3	2.0	7.1	6.4
<i>Epithemia sorex</i> (3)	10.8	1.8				0.3
<i>Gomphonema parvulum</i> (1)	8.0	0.3	9.6	0.5	0.8	0.9
<i>Navicula luzonensis</i> (1)			11.6		1.3	
<i>Navicula pelliculosa</i> (1)			16.8			
<i>Navicula secreta</i> (2)		0.3		0.4	2.9	30.5
<i>Nitzschia dissipata</i> (3)	1.0	17.5		0.3	13.2	29.1
<i>Nitzschia kutzingiana</i> (2)	0.4	12.0	24.8		2.8	1.0
<i>Nitzschia sociabilis</i> (2)					12.4	
<i>Rhoicosphenia curvata</i> (3)	7.9	0.5		68.5	4.6	2.5
<i>Surirella minuta</i> (2)	1.1	4.0			17.3	2.5
<i>Synedra ulna</i> (2)	0.6	10.6	2.0	0.5	0.3	1.4
Frustules Counted	400	400	400	400	400	400
Taxa Counted	51	52	35	26	41	43
Diversity Index (Shannon)	3.65	3.54	2.98	1.67	3.29	2.90
Percentage	100	100	82	47	90	82
Pollution Index	2.57	2.44	1.61	2.92	2.31	2.49
Percentage	100	100	63	120	90	102
Siltation Index	20.6	53.6	67.6	12.8	77.5	72.4
Percentage	100	100	30	419	27	74
Similarity Index	100	100	26.0	13.5	29.0	41.6

* The number in parentheses following the species name is the pollution tolerance class:

1 = Most tolerant of pollution

2 = Somewhat tolerant of pollution

3 = Sensitive to pollution

Figure 5. Pollution Index (Based on Diatom Species Composition) in Ashley Creek, 1984 and 1994.

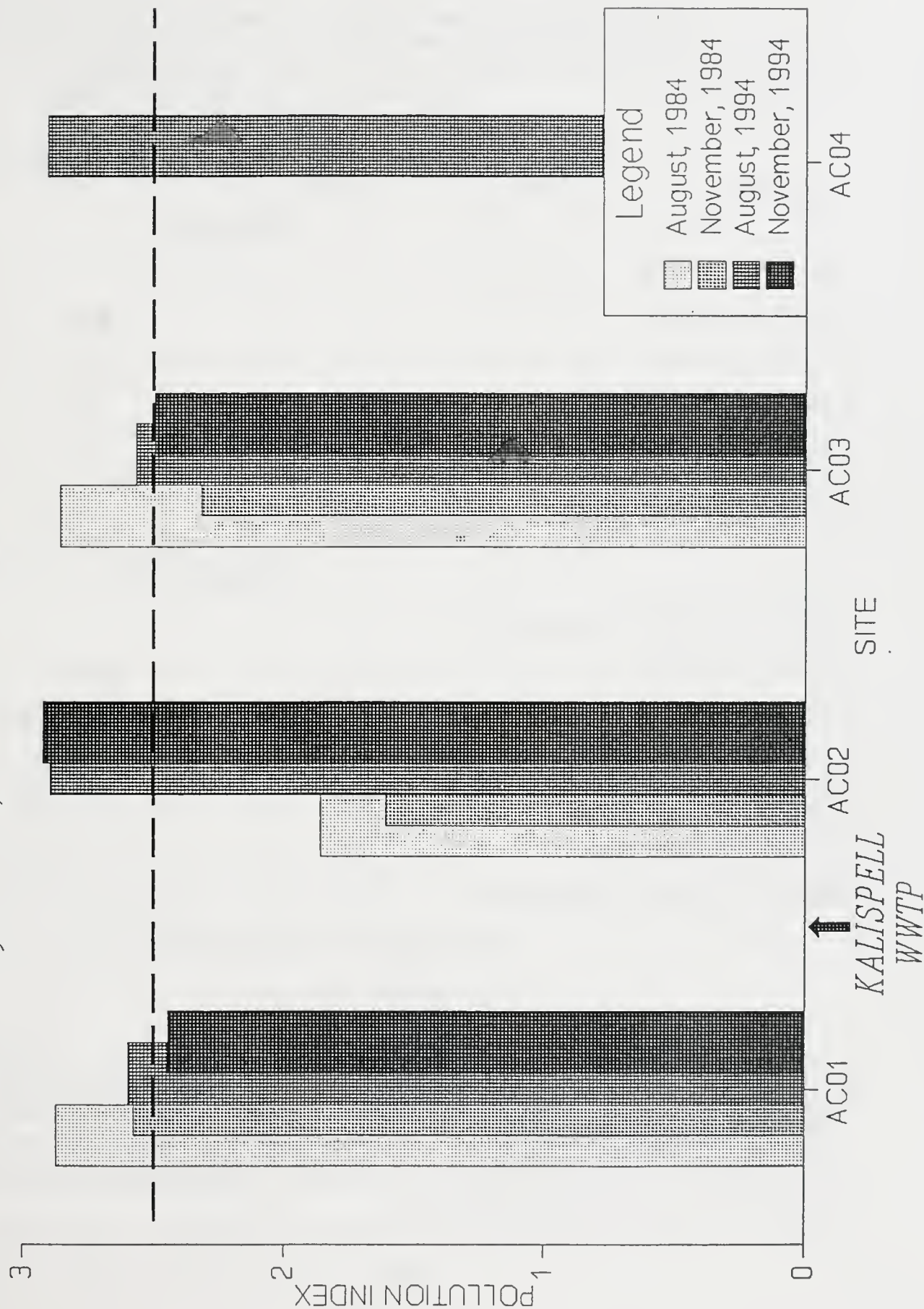


Table 5. Bioassessment scores and ratings of biological integrity in **Ashley Creek** based on diatom associations collected in August 1984 and August 1994.

Metric	Station						
	AC01		AC02		AC03		AC04
	1984	1994	1984	1994	1984	1994	1994
<u>PROTOCOL I</u>							
Diversity Index	4	4	3	2	4	4	2
Pollution Index	4	4	3	4	4	4	4
Siltation Index	4	3	1	4	4	2	4
Disturbance Index*	4	4	4	4	4	4	4
Lowest Score	4	3	1	2	4	2	2
Biological Integrity	E	G	P	F	E	F	F
<u>PROTOCOL II</u>							
Diversity Index	4	4	3	2	4	4	2
Pollution Index	4	4	3	4	4	4	4
Siltation Index	4	4	1	4	4	4	4
Similarity Index	4	4	1	2	3	3	2
Lowest Score	4	4	1	2	3	3	2
Biological Integrity	E**	E**	P	F	G	G	F

Key to Biological Integrity:

E = Excellent
 G = Good
 F = Fair
 P = Poor

* The disturbance index is based on the percent relative abundance of *Achnanthes minutissima*: PRA <25 = no disturbance; PRA 25-50 = minor disturbance; PRA 50-75 = moderate disturbance; PRA >75 = major disturbance.

** Biological integrity at the upstream control site is always excellent under Protocol II.

Table 6. Bioassessment scores and ratings of biological integrity in **Ashley Creek** based on diatom associations collected in November 1984 and November 1994.

Metric	AC01		Station AC02		AC03	
	1984	1994	1984	1994	1984	1994
<u>PROTOCOL I</u>						
Diversity Index	4	4	4	2	4	4
Pollution Index	4	3	2	4	3	3
Siltation Index	3	2	1	4	1	1
Disturbance Index*	4	4	4	4	4	4
Lowest Score	3	2	1	2	1	1
Biological Integrity	G	F	P	F	P	P
<u>PROTOCOL II</u>						
Diversity Index	4	4	4	2	4	4
Pollution Index	4	4	2	4	3	4
Siltation Index	4	4	2	4	2	4
Similarity Index	4	4	2	1	2	3
Lowest Score	4	4	2	1	2	3
Biological Integrity	E''	E''	F	P	F	G

Key to Biological Integrity:

E = Excellent
 G = Good
 F = Fair
 P = Poor

* The disturbance index is based on the percent relative abundance of *Achnanthes minutissima*: PRA <25 = no disturbance; PRA 25-50 = minor disturbance; PRA 50-75 = moderate disturbance; PRA >75 = major disturbance.

'' Biological integrity at the upstream control site is always excellent under Protocol II.

However, using Protocol II and the Airport Road site as the reference site, biological integrity declined from "fair" in November 1984 to "poor" in November 1994 below the Kalispell WWTP (Table 6). This decline was due to a very low similarity index value in November 1994 when the diatom association at the Cemetery Road site was compared to the diatom association at the Airport Road site. This corresponded to the time when the Kalispell WWTP was receiving, treating and discharging most of the wastewater from Evergreen. The site below the wastewater plant, dominated by enlarged wastewater flows, evidently supported a diatom flora that was very unlike the one that occupied the upstream station.

Biological integrity at Highway 93 and near the mouth of Ashley Creek ranged from "poor" to "good" in 1994 depending on the site, the month, and the protocol used (Tables 5 and 6). A combination of nonpoint sources and residual effects from the Kalispell effluent accounted for less than full support of biological integrity in these lower reaches of Ashley Creek.

East Spring Creek

Limited water quality data from East Spring Creek at the time of periphyton sampling (Appendix B) show generally decreasing water temperatures, decreasing pH values, and increasing specific conductance values in a downstream direction. This may indicate increasing influence by groundwater in the lower reaches of the stream. East Spring Creek is a springbrook that emerges from a paleochannel on the ancient floodplain of the Flathead River (Stanford et al. 1994). The relatively warm water temperature (19.1 C) at the uppermost site on East Spring Creek (SC01) was due to ponding behind a small dam located immediately above this site.

Diatom diversity was very low at the upstream site (SC01), but normal at the other three sites (Table 7 and Figure 6). The low diatom diversity corresponded to dominance (78.8%) by *Cymbella affinis*. This is also a dominant species in the middle reaches of the Clark Fork River between the Blackfoot and Flathead Rivers (Weber 1991). *Cymbella affinis* prefers warmer, flowing waters and moderate levels of nutrients.

Table 7. Percent relative abundance of major diatom species and values of selected diatom metrics for periphyton samples collected from East Spring Creek and Trumbull Creek in August 1994.

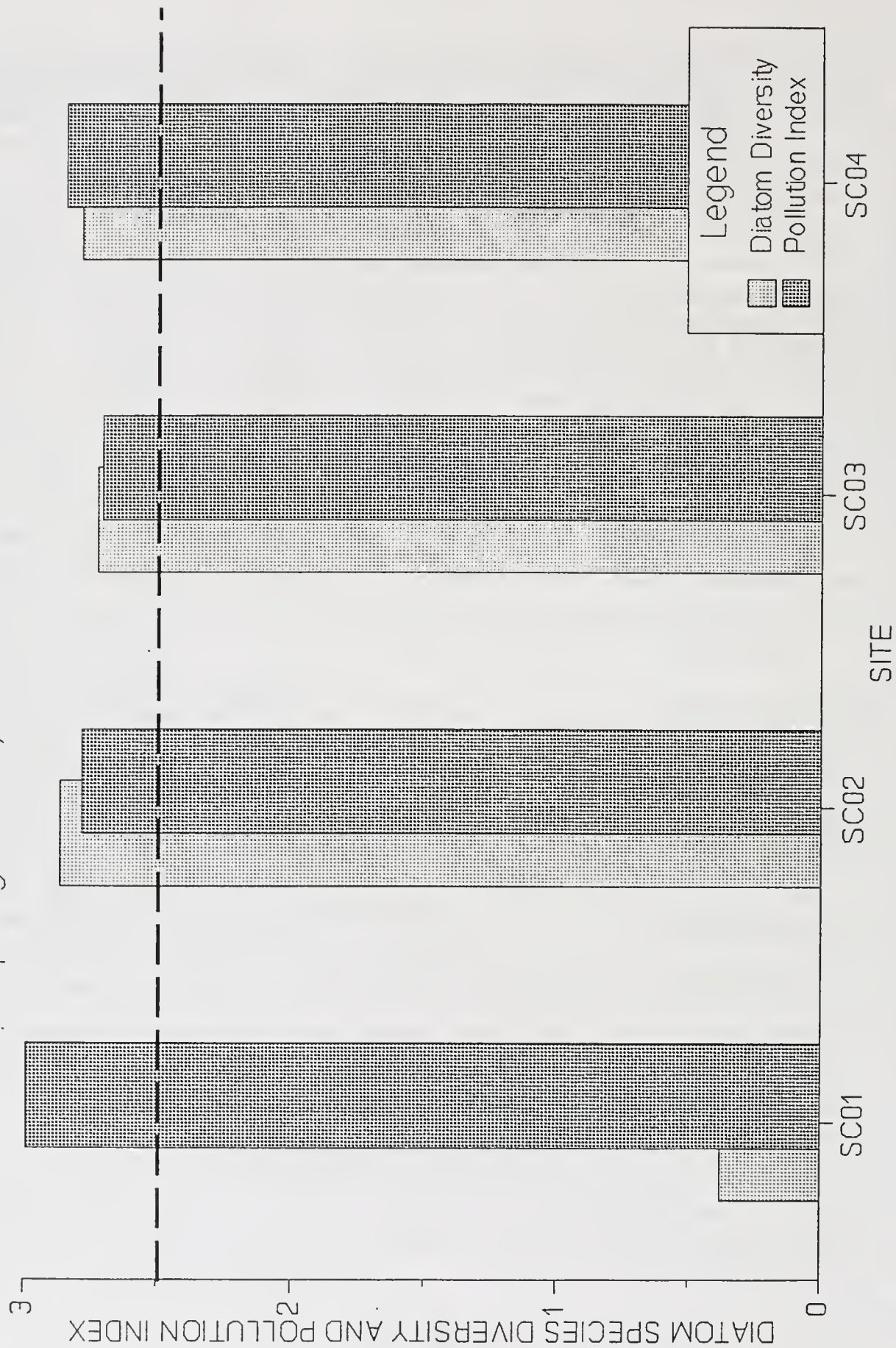
Species/Metric**	Station			
	SC01*	SC02*	SC03	SC04*
<i>Achnanthes affinis</i> (3)		7.0	7.8	15.6
<i>Achnanthes deflexa</i> (3)	0.2	9.6	19.5	8.8
<i>Achnanthes minutissima</i> (3)	7.3	33.2	23.9	23.4
<i>Cocconeis placentula</i> (3)	7.6	0.4	0.1	1.0
<i>Cymbella affinis</i> (3)	78.8	1.6	0.6	9.0
<i>Cymbella cistula</i> (3)	2.0	1.4	10.5	2.7
<i>Cymbella microcephala</i> (2)	0.6	9.6	7.8	1.2
<i>Fragilaria pinnata</i> (3)	0.4	9.9	2.0	9.6
<i>Synedra ulna</i> (2)	1.0	1.0	13.2	7.8
Frustules Counted	400	400	400	400
Taxa Counted	16	34	31	31
Diversity Index (Shannon)	0.91	2.86	2.72	2.78
Percentage	32	100	95	97
Pollution Index	2.98	2.78	2.70	2.84
Percentage	107	100	97	102
Siltation Index	0.8	5.4	1.0	2.0
Percentage	675	100	540	270
Similarity Index	14	100	56.7	58.3

* Values for SC01, SC02, and SC04 are mean values based on two replicate samples.

** The number in parentheses following the species name is the pollution tolerance class:

- 1 = Most tolerant of pollution
- 2 = Somewhat tolerant of pollution
- 3 = Sensitive to pollution

Figure 6. Diatom Species Diversity and Pollution Index Values in East Spring Creek, 1994.



The pollution index indicated good water quality in East Spring Creek. Pollution index values exceeded the 2.50 criterion at all sites (Table 7 and Figure 6).

Bioassessment scores and ratings (Table 8) indicate "poor" biological integrity at the upstream site (SC01) because of the very low biological diversity and a diatom flora that was very dissimilar from the flora at the control site on Trumbull Creek (SC02). The other two sites on East Spring Creek had "good" or "excellent" biological integrity, indicating little or no impairment following completion of the stream rehabilitation project sponsored by the Flathead Conservation District (1992).

Stillwater River

On November 30, 1994, the Stillwater River experienced a six-fold increase in nitrate nitrogen concentrations between the upstream site below Logan Creek and the downstream site near Kalispell (Figure 7). Smaller proportionate increases between these two sites were recorded for chloride, ortho-phosphate, specific conductance, and total phosphorus (Appendix B).

Diatom diversity remained virtually unchanged between the two sites, but the pollution index decreased to just below the 2.50 threshold at the downstream site (Table 9 and Figure 8). This marginal pollution index, coupled with a marginal siltation index and a somewhat dissimilar diatom flora resulted in a biological integrity rating of "good" at the downstream site (Table 10). Biological integrity at the upstream site rated "excellent".

Whitefish River

Nitrate and ammonia nitrogen values in the Whitefish River increased from above to below the Whitefish WWTP in both 1992 and 1994 (Figure 9). The increases were larger in 1994 than in 1992. While ammonia nitrogen declined between Highway 40 and Evergreen, nitrate nitrogen continued to increase (Figure 9). This may be due to a combination of nitrification of residual ammonia and influx of polluted groundwater in the lower reaches of the river.

Smaller proportionate increases were also recorded both years

Table 8. Bioassessment scores and ratings of biological integrity in East Spring Creek and Trumbull Creek based on diatom associations collected in August 1994.

Metric	Station			
	SC01	SC02	SC03	SC04
<u>PROTOCOL I</u>				
Diversity Index	1	4	4	4
Pollution Index	4	4	4	4
Siltation Index	4	4	4	4
Disturbance Index*	4	3	4	4
Lowest Score	1	3	4	4
Biological Integrity	P	G	E	E
<u>PROTOCOL II</u>				
Diversity Index	1	4	4	4
Pollution Index	4	4	4	4
Siltation Index	4	4	4	4
Similarity Index	1	4	3	3
Lowest Score	1	4	3	3
Biological Integrity	P	E**	G	G

Key to Biological Integrity:

E = Excellent
 G = Good
 F = Fair
 P = Poor

* The disturbance index is based on the percent relative abundance of *Achnanthes minutissima*: PRA <25 = no disturbance; PRA 25-50 = minor disturbance; PRA 50-75 = moderate disturbance; PRA >75 = major disturbance.

** Biological integrity at the control or reference site is always excellent under Protocol II.

Figure 7. Nitrate and Ammonia Nitrogen Concentrations in Stillwater River, November 1994.

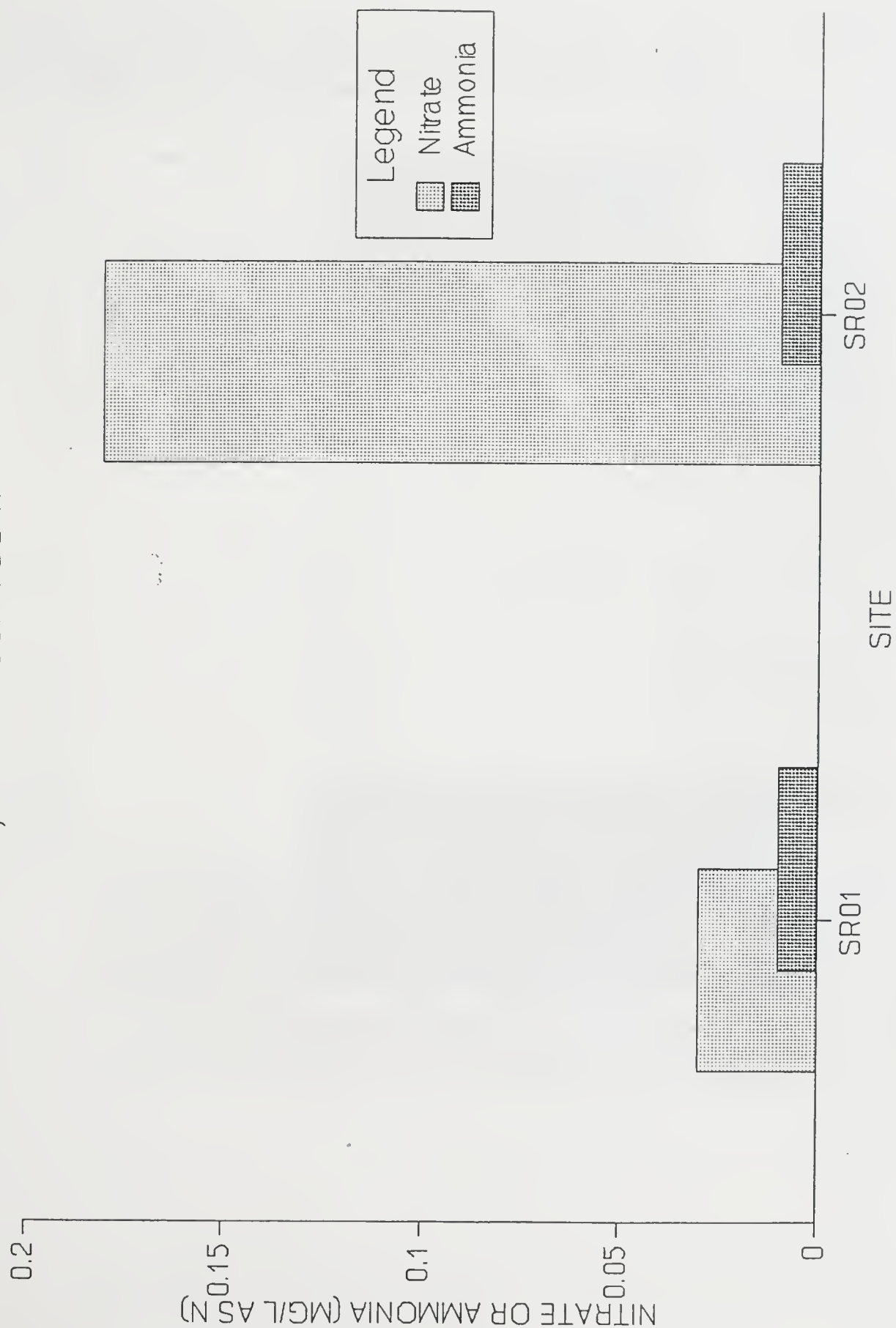


Table 9. Percent relative abundance of major diatom species and values of selected diatom metrics for periphyton samples collected from the Stillwater River in November 1994.

Species/Metric*	Station	
	SR01	SR02
<i>Achnanthes minutissima</i> (3)	21.4	11.5
<i>Cocconeis placentula</i> (3)	13.9	2.4
<i>Cymbella microcephala</i> (2)	5.1	8.8
<i>Fragilaria construens</i> (3)	0.8	5.8
<i>Fragilaria pinnata</i> (3)	7.3	6.0
<i>Fragilaria vaucheriae</i> (2)	4.3	8.4
<i>Synedra minuscula</i> (3)	0.3	5.8
<i>Synedra rumpens</i> (2)	11.4	3.2
<i>Synedra ulna</i> (2)	5.8	14.5
Frustules Counted	400	400
Taxa Counted	60	52
Diversity Index (Shannon)	3.57	3.63
Percentage	100	102
Pollution Index	2.56	2.40
Percentage	100	94
Siltation Index	10.8	22.8
Percentage	100	47
Similarity Index	100	50.9

* The number in parentheses following the species name is the pollution tolerance class:

- 1 = Most tolerant of pollution
- 2 = Somewhat tolerant of pollution
- 3 = Sensitive to pollution

Figure 8. Diatom Species Diversity and Pollution Index Values in Stillwater River, 1994.

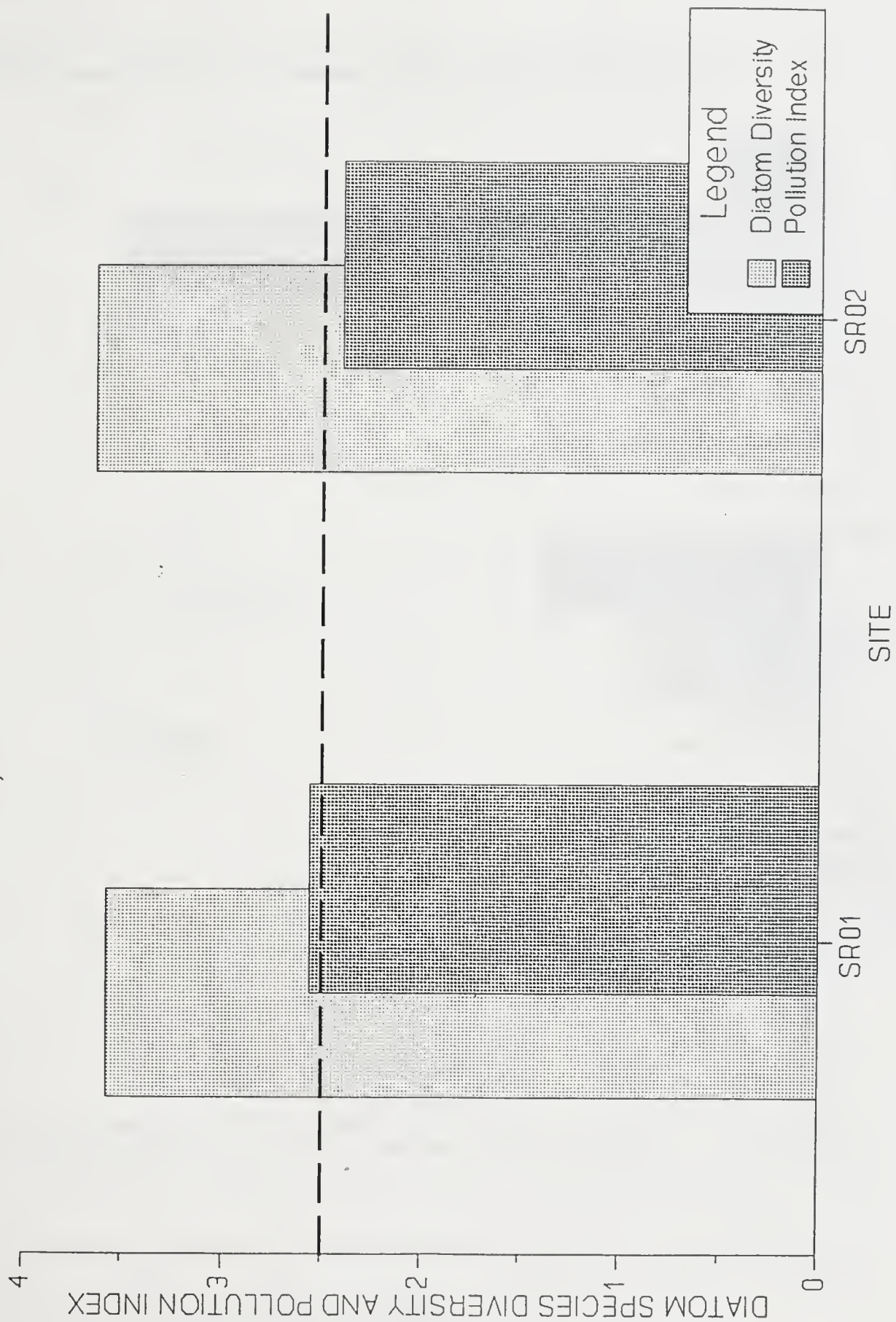


Table 10. Bioassessment scores and ratings of biological integrity in the Stillwater River based on diatom associations collected in November 1994.

Metric	Station	
	SR01	SR02
<u>PROTOCOL I</u>		
Diversity Index	4	4
Pollution Index	4	3
Siltation Index	4	3
Disturbance Index*	4	4
Lowest Score	4	3
Biological Integrity	E	G
<u>PROTOCOL II</u>		
Diversity Index	4	4
Pollution Index	4	4
Siltation Index	4	3
Similarity Index	4	3
Lowest Score	4	3
Biological Integrity	E**	G

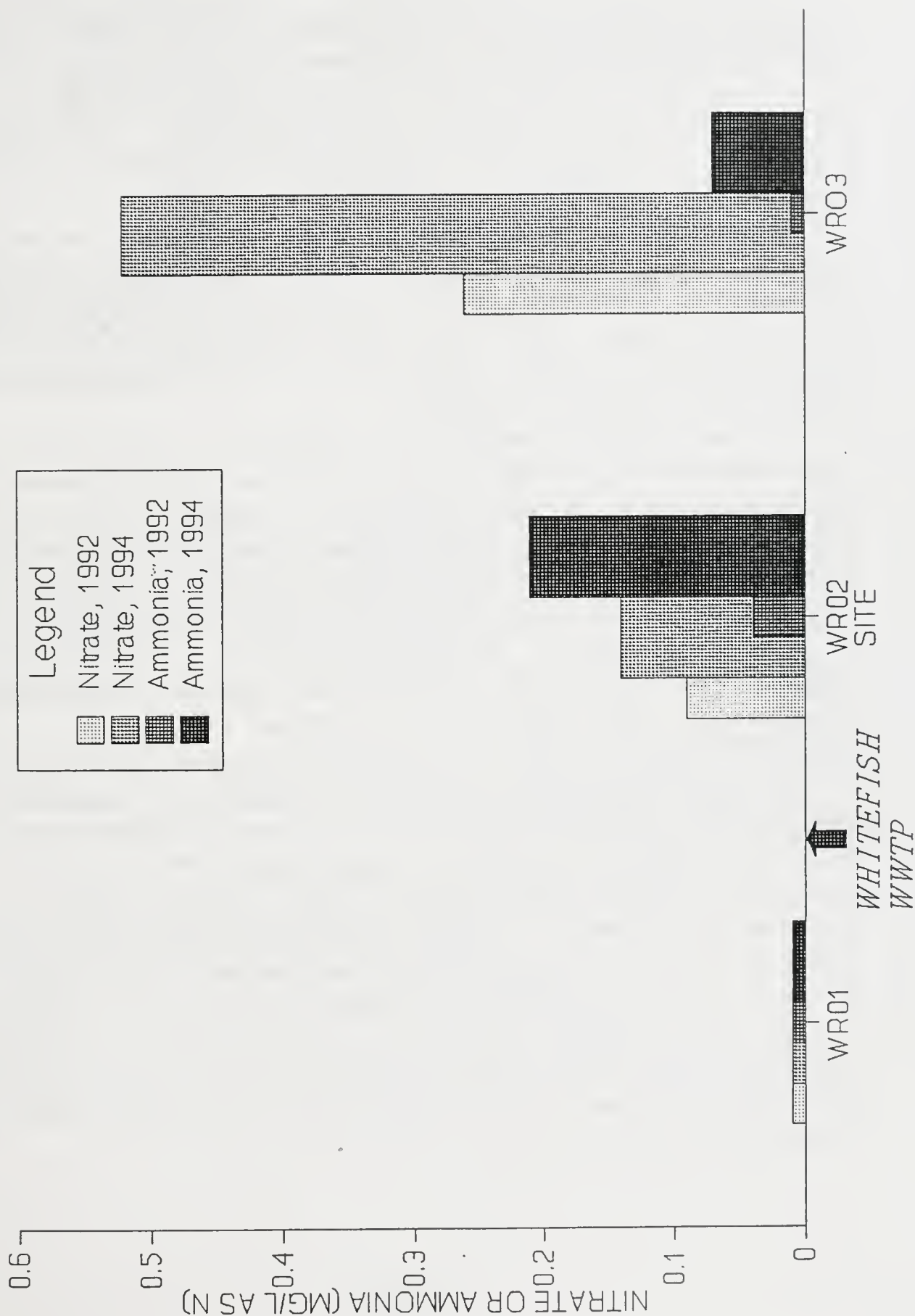
Key to Biological Integrity:

E = Excellent
 G = Good
 F = Fair
 P = Poor

* The disturbance index is based on the percent relative abundance of *Achnanthes minutissima*: PRA <25 = no disturbance; PRA 25-50 = minor disturbance; PRA 50-75 = moderate disturbance; PRA >75 = major disturbance.

** Biological integrity at the upstream control site is always excellent under Protocol II.

Figure 9. Nitrate and Ammonia Nitrogen Concentrations in Whitefish River, 1992 and 1994.



for chloride, ortho-phosphate, specific conductance, and total phosphorus from the lake outlet to Highway 40 (Appendix B). Ortho-phosphate and total phosphorus concentrations declined from Highway 40 to Evergreen, probably due to nutrient uptake by algae and to phosphorus adsorption onto river sediments, but chloride concentrations and specific conductance continued to increase downstream.

Unpublished data collected by the University of Montana Flathead Lake Biological Station since 1982 show substantial increases in mean concentrations for soluble reactive phosphorus, soluble phosphorus, nitrate nitrogen, total Kjeldahl nitrogen, and dissolved organic carbon between the lake outlet and Reserve Drive (Bonnie Ellis, UM/FLBS, 10/8/92).

Diatom diversity declined to problematic levels below the Whitefish WWTP in both 1992 and 1994, but then rebounded to maximum recorded levels at the River Road site in Evergreen (Table 11 and Figure 10). Pollution index values remained above the 2.50 criterion at all three site in both years (Table 11 and Figure 10).

Bioassessment scores and ratings (Table 12) indicate "fair" biological integrity at the Highway 40 site in 1992, but "poor" biological integrity at this site in 1994 using the more sensitive Protocol II. The basis for this "poor" rating was a very dissimilar diatom flora at the site below the WWTP compared to the flora at the lake outlet. Between the 1992 and 1994 sample dates, the Whitefish WWTP bypassed all or a part of their treatment facility and discharged untreated sewage to the Whitefish River on multiple occasions (MPDES Permit Files, Montana Department of Environmental Quality). This, coupled with additional service connections and wastewater flow, may explain the decline in biological integrity from 1992 to 1994.

At the Evergreen site, the Whitefish River had "fair" biological integrity in both 1992 and 1994 using Protocol II, owing to a moderately high siltation index value in 1992 and a moderately low similarity index value in 1994 (Table 12).

Table 11. Percent relative abundance of major diatom species and values of selected diatom metrics for periphyton samples collected from the Whitefish River in November 1992 and November 1994.

Species/Metric*	Station		Station		Station	
	WR01		WR02		WR03	
	1992	1994	1992	1994	1992	1994
<i>Achnanthes deflexa</i> (3)				3.0	5.3	14.4
<i>Achnanthes minutissima</i> (3)	25.1	11.5	56.4	49.3	28.1	24.5
<i>Cocconeis placentula</i> (3)	0.4		11.6	11.2	0.9	3.3
<i>Cymbella microcephala</i> (2)	4.9	5.9	5.2	0.6	12.0	9.1
<i>Fragilaria construens</i> (3)	3.5	16.4	0.3		2.5	3.3
<i>Fragilaria pinnata</i> (3)	37.5	31.6	0.5	1.0	3.3	7.5
Frustules Counted	400	400	400	400	400	400
Taxa Counted	50	49	47	41	64	47
Diversity Index (Shannon)	2.63	3.19	2.29	2.52	3.59	3.33
Percentage	100	100	87	79	136	104
Pollution Index	2.79	2.65	2.85	2.80	2.60	2.69
Percentage	100	100	102	106	93	102
Siltation Index	8.0	15.0	9.4	25.9	20.0	15.5
Percentage	100	100	85	58	40	97
Similarity Index	100	100	36.9	18.5	43.0	33.9

* The number in parentheses following the species name is the pollution tolerance class:

- 1 = Most tolerant of pollution
- 2 = Somewhat tolerant of pollution
- 3 = Sensitive to pollution

Figure 10. Diatom Species Diversity and Pollution Index Values in Whitefish River, 1992 and 1994.

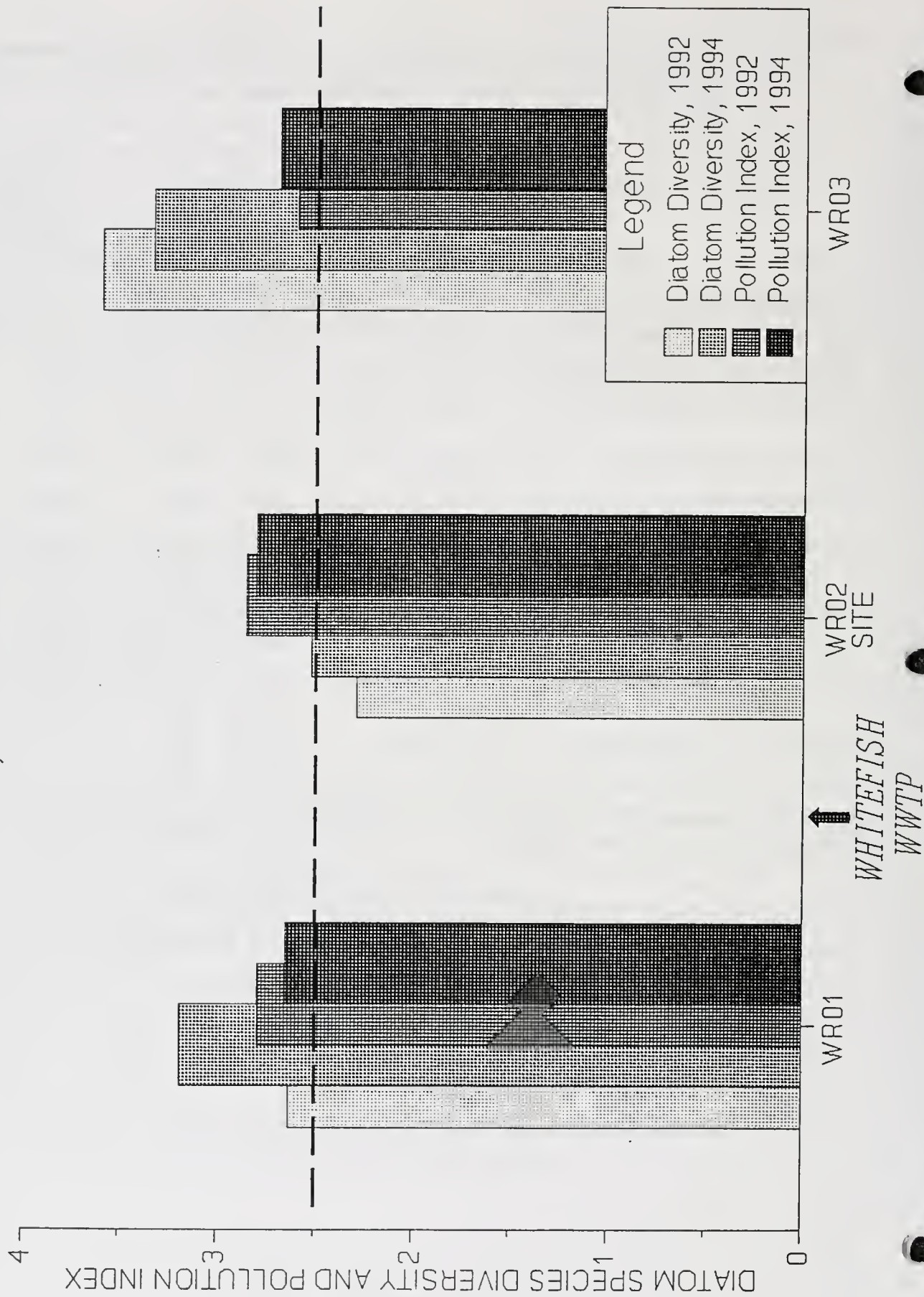


Table 12. Bioassessment scores and ratings of biological integrity in the **Whitefish River** based on diatom associations collected in November 1992 and November 1994.

Metric	WR01		Station WR02		WR03	
	1992	1994	1992	1994	1992	1994
<u>PROTOCOL I</u>						
Diversity Index	4	4	3	4	4	4
Pollution Index	4	4	4	4	4	4
Siltation Index	4	4	4	3	3	4
Disturbance Index*	3	4	2	3	3	4
Lowest Score	3	4	2	3	3	4
Biological Integrity	G	E	F	G	G	E
<u>PROTOCOL II</u>						
Diversity Index	4	4	4	3	3	4
Pollution Index	4	4	4	4	4	4
Siltation Index	4	4	4	3	2	4
Similarity Index	4	4	2	1	3	2
Lowest Score	4	4	2	1	2	2
Biological Integrity	E''	E''	F	P	F	F

Key to Biological Integrity:

E = Excellent
 G = Good
 F = Fair
 P = Poor

* The disturbance index is based on the percent relative abundance of *Achnanthes minutissima*: PRA <25 = no disturbance; PRA 25-50 = minor disturbance; PRA 50-75 = moderate disturbance; PRA >75 = major disturbance.

'' Biological integrity at the upstream control site is always excellent under Protocol II.

Acknowledgements

I would like to thank Gary Ingman and Erich Weber for planning and performing the field work for this project in 1984. Kevin Hardy prepared Figures 2 through 10 in this report.

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Appendix A

Periphyton Biocriteria For Applying Protocol I (Table 10A) And
Protocol II (Table 12) (from Bahls 1993)

Table 10A. Impairment ratings and scores for diatom association indexes from **mountain** streams when a local reference or control site is not available.

Score	Rating	Diversity Index	Pollution Index	Siltation Index
1	high stress	< 1.00		
	severe pollution		< 1.50	
	heavy siltation			> 60
2	moderate stress	1.00 - 1.75		
	moderate pollution		1.50 - 2.00	
	moderate siltation			40 - 60
3	minor stress	1.76 - 2.50		
	minor pollution		2.01 - 2.50	
	minor siltation			20 - 39
4	no stress	> 2.50		
	no pollution		> 2.50	
	no siltation			< 20

Lowest Score

Biological Integrity

Overall Impairment

1	poor	severe
2	fair	moderate
3	good	minor
4	excellent	none

Table 12. Impairment ratings and scores for diatom association indexes when a local reference or control site is available and used.

Score	Rating	Diversity Index ^(a)	Pollution Index ^(a)	Siltation Index ^(b)	Similarity Index ^(c)
1	high stress	<40% >160%			
	severe pollution		<50%		
	heavy siltation increase			<20%	
	very dissimilar communities				<20%
2	moderate stress	40 - 60% 140 - 160%			
	moderate pollution		50 - 70%		
	moderate siltation increase			20 - 40%	
	somewhat dissimilar communities				20 - 40%
3	minor stress	61 - 80% 120 - 139%			
	minor pollution		71 - 90%		
	small siltation increase			41 - 60%	
	somewhat similar communities				41 - 60%
4	no stress	>80% <120%			
	no pollution		>90%		
	no siltation increase			>60%	
	very similar communities				>60%

^(a)Value is ratio of study site index to reference site index x 100.

^(b)Value is ratio of reference site index to study site index x 100.

^(c)Percent community similarity (Whittaker and Fairbanks 1958).

<u>Lowest Score</u>	<u>Biological Integrity</u>	<u>Overall Impairment</u>
1	poor	severe
2	fair	moderate
3	good	minor
4	excellent	none

Appendix B

Laboratory Water Quality Reports

STATE MONTANA COUNTY FLATHEAD
LAT.-LONG. 481034N 1141834W SAMPLE LOCATION 28N 21W 19ADD
TATION CODE ANALYSIS NUMBER 84W1495
DATE SAMPLED 08-22-84 DRAINAGE BASIN 76LJ -U.FLTHD R.
TIME SAMPLED 1445 WATER FLOW RATE 10.8 CFS(M)
METH SAMPLED GRAB+DEPTH TSS FLOW MEASUREMENT METHOD FLOW METER
SAMPLE SOURCE STREAM ALTITUDE OF LAND SURFACE
WATER USE MULTIPLE TOTAL WELL DEPTH BELOW LS
AQUIFER(S) SWL ABOVE(+) OR BELOW LS
SAMPLED BY WGBH SAMPLE DEPTH BELOW SURFACE

SAMPLING SITE: ~~ASHLEY CREEK~~ ABOVE KALISPELL WTP DISCH.

	MG/L	MEQ/L		MG/L	MEQ/L
ALCIUM (CA)	33.5	1.672	BICARBONATE(HCO3)	187.9	3.079
MESIUM (MG)	12.8	1.053	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	6.1	0.265	CHLORIDE (CL)	1.7	0.048
ASSIUM (K)			SULFATE (SC4)	2.5	0.052
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	0.038	0.004
			NO3+NO2 (TOT AS N)	0.01	0.001

SUM CATIONS 52.4 2.990 SUM ANIONS 192.1 3.184

LABCRATORY PH		TOT HARDNESS(MG/L-CACO3)	136
D WATER TEMPERATURE (C)	20.6	TOT ALKALINITY(MG/L-CACO3)	154
DISS. IONS MEAS.(MG/L)	244.6	LABORATORY TURBIDITY (NTU)	7.0
B CONDUCTIVITY-UMHOS-25C		SODIUM ADSORPTION RATIO	0.2

A D D I T I O N A L		P A R A M E T E R S	
IMENT,TCT,SUSP (MG/L)	8.5	PHOSPHOROUS,TOT (MG/L-P)	.03
MONIA,TCTAL(MG/L AS N)	.01	NITROGEN,KJL,TOT(MG/L-N)	1.0
PH,FIELD(SU)	8.75	OXYGEN, DISS (MG/L AS O)	12.90
5-DAY-20C(MG/L AS O)	< 2.0		

ARKS: ASHLEY CREEK RECOVERY ABOVE AIRPORT ROAD CROSSING

ES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TCT=TOTAL SUSP=SUSPENDED
TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PLE NO-01 SAMPLER-GLI HANDLING-4100 ANALYST-WAT LAB- WGB SCAN-NO
PLETED-09/12/84 COMPUTER RUN-09/19/84 DATA-0684/PGM-0684 FUND-2053
C DEV. IGN BALANCE= 1.25 CA MG NA K CL SO4 HCO3 CO3 NO3
ES- 55.9 35.2 8.9 0.0 1.5 1.6 96.9 0.0 0.0
C. MEQ/L= SC N/A, NO CALC. 84W1495

STATE	MONTANA	COUNTY	FLATHEAD
LAT.-LONG.	480955N 1141756W	SAMPLE LOCATION	28N 21W 296AD
CON CODE		ANALYSIS NUMBER	84W1497
SAMPLED	06-22-84	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	1515	WATER FLOW RATE	13.5 CFS(E)
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	NOT MEASURED
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: ASHLEY CREEK BELOW KALISPELL WWTP DISCH.

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	35.9	1.791	BICARBONATE (HCO3)	200.1	3.279
MAGNESIUM (MG)	14.8	1.218	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	39.3	1.710	CHLORIDE (CL)	35.7	1.007
POTASSIUM (K)			SULFATE (SO4)	10.5	0.219
			FLUORIDE (F)		
			PHOSPHATE (PO4 AS P)	2.18	0.211
			NO3+NO2 (TOT AS N)	.44	0.031

SUM CATIONS	90.0	4.713	SUM ANIONS	246.9	4.747
-------------	------	-------	------------	-------	-------

LABORATORY PH		TOT HARDNESS (MG/L-CACO3)	151
FIELD WATER TEMPERATURE (C)	19.4	TOT ALKALINITY (MG/L-CACO3)	164
SS. IONS MEAS. (MG/L)	345.0	LABORATORY TURBIDITY (NTU)	3.2
CONDUCTIVITY-UNHOS-25C		SODIUM ADSORPTION RATIO	1.4

A D D I T I O N A L		P A R A M E T E R S	
SEDIMENT, TOT, SUSP (MG/L)<	2.7	PHOSPHORUS, TOT (MG/L-P)	2.45
AMMONIA, TOTAL (MG/L AS N)	4.29	NITROGEN, KJL, TOT (MG/L-N)	7.4
PH, FIELD (SU)	7.65	OXYGEN, DISS (MG/L AS O)	2.50
DO, 5-DAY-20C (MG/L AS O)	2.7		

MARKS: ASHLEY CREEK RECOVERY UPSTREAM CEMETARY ROAD CROSSING.

TESTS: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 - CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 =TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

 SAMPLE NO-03 SAMPLER-GLI HANDLING-4100 ANALYST-WAT LAB-WQB SCAN-NO
 MPI ED-09/25/84 COMPUTER RUN-10/11/84 DATA-0684/PGM-0984 FUND-2053
 • ION BALANCE= 0.16 CA MG NA K CL SO4 HCO3 CO3 NO3
 38.0 25.8 36.2 0.0 22.3 4.9 72.8 0.0 0.0
 C. MEQ/L= SC N/A, NO CALC. 84W1497

STATE	MONTANA	COUNTY	FLATHEAD
LAT.-LONG.		SAMPLE LOCATION	
TATION CODE		ANALYSIS NUMBER	84W1498
DATE SAMPLED	08-22-84	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	1530	WATER FLOW RATE	13.5 CFS(E)
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	NOT MEASURED
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: ASHLEY CREEK AT HWY 93 CROSSING

	MG/L	MEQ/L		MG/L	MEQ/L
ALCIUM (CA)	35.6	1.776	BICARBONATE(HCO3)	191.5	3.139
MAGNESIUM (MG)	13.6	1.119	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	24.7	1.074	CHLORIDE (CL)	21.2	0.598
POTASSIUM (K)			SULFATE (SO4)	7.6	0.158
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	0.420	0.041
			NO3+NO2 (TOT AS N)	2.18	0.156

SUM CATIONS	73.9	3.970	SUM ANIONS	222.9	4.092
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LABORATORY PH		TOT HARDNESS(MG/L-CACO3)	145
FIELD WATER TEMPERATURE (C)	19.4	TOT ALKALINITY(MG/L-CACO3)	157
-DISS. IONS MEAS.(MG/L)	305.1	LABORATORY TURBIDITY (NTU)	6.2
B CONDUCTIVITY-UMHOS-25C		SODIUM ADSORPTION RATIO	0.9

ADDITIONAL		PARAMETERS	
SILICUM, TOT, SUSP (MG/L)	11.2	PHOSPHOROUS, TOT (MG/L-P)	.43
AMMONIA, TOTAL(MG/L AS N)	.09	NITROGEN, KJL, TOT(MG/L-N)	1.4
PH, FIELD(SU)	7.85	OXYGEN, DISS (MG/L AS O)	7.10
D.O.-DAY-20C(MG/L AS O)	< 2.0		

WORKS: ASHLEY CREEK RECOVERY

UNITS: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

ANALYSIS NO-04 SAMPLER-GLI HANDLING-4100 ANALYST-WAT LAB- WQB SCAN-NO
COMPLETED-09/12/84 COMPUTER RUN-09/19/84 DATA-0684/PGM-0684 FUND-2053
C DEV. ION BALANCE= 0.72 CA MG NA K CL SO4 HCO3 CO3 NO3
ES- 44.8 28.2 27.1 0.0 15.3 4.1 80.6 0.0 0.0
C. MEQ/L= SC N/A, NO CALC. 84W1498

STATE	MONTANA	COUNTY	FLATHEAD
LONG.	460850N 1141256W	SAMPLE LOCATION	28N 21A 36BDC
N CODE		ANALYSIS NUMBER	84W1499
DATE SAMPLED	08-22-84	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	1000	WATER FLOW RATE	20. CFS(E)
MGD SAMPLED	GRAE	FLOW MEASUREMENT METHOD	NOT MEASURED
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: ASHLEY CREEK NEAR MOUTH ON FLATHEAD RIVER

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	32.7	1.632	BICARBONATE(HCO3)	179.3	2.939
MAGNESIUM (MG)	11.6	0.954	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	17.6	0.766	CHLORIDE (CL)	13.4	0.378
POTASSIUM (K)			SULFATE (SO4)	5.0	0.104
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	0.670	0.065
			NO3+NO2 (TOT AS N)	0.04	0.003

SUM CATIONS	61.9	3.352	SUM ANIONS	198.4	3.489
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LABORATORY PH		TOT HARDNESS(MG/L-CACO3)	129
WATER TEMPERATURE (C)	18.4	TOT ALKALINITY(MG/L-CACO3)	147
S. IONS MEAS.(MG/L)	261.9	LABORATORY TURBIDITY (NTU)	3.0
CONDUCTIVITY-UMHOS-25C		SODIUM ADSORPTION RATIO	0.7

A D D I T I O N A L		P A R A M E T E R S	
SEDIMENT, TOT, SUSP (MG/L)	7.3	PHOSPHOROUS, TOT (MG/L-P)	.70
AMONIA, TOTAL (MG/L AS N)	.03	NITROGEN, KJL, TOT (MG/L-N)	2.2
PH, FIELD (SU)	8.10	OXYGEN, DISS (MG/L AS O)	7.60
10, 5-DAY-20C (MG/L AS O)	7.0		

MARKS: ASHLEY CREEK RECOVERY AT COUNTY ROAD 1 MILE ABOVE MOUTH
 SMALL WHITE LIFE IN UNPRES SAMPL
 ES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PL NO-05 SAMPLER-GLI HANDLING-4100 ANALYST-WAT LAB- WQB SCAN-NO
 ID-09/12/84 COMPUTER RUN-09/19/84 DATA-0684/PGM-0684 FUND-2053
 V. ION BALANCE= 0.86 CA MG NA K CL SO4 HCO3 CO3 NO3
 ES- 48.7 28.5 22.8 0.0 11.0 3.0 85.9 0.0 0.0
 C. MEQ/L= SC N/A, NO CALC. 84W1499

STATE	MONTANA	COUNTY	FLATHEAD
LAT.-LONG.	481034N 1141834W	SAMPLE LOCATION	28N 21W 19ADD
TATION CODE		ANALYSIS NUMBER	84W2206
ATE SAMPLED	11-15-84 S	DRAINAGE BASIN	76LJ -U.FLTHD R.
IME SAMPLED	0810	WATER FLOW RATE	17.6 CFS(M)
MOD SAMPLED	GRAB+DEPTH TSS	FLOW MEASUREMENT METHOD	FLOW METER
MPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: ASHLEY CREEK ABOVE KALISPELL WWT P DISCH.

	MG/L	MEQ/L		MG/L	MEQ/L
ALCIUM (CA)	39.7	1.981	BICARBONATE(HCO3)	197.6	3.239
NESIUM (MG)	12.6	1.037	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	8.5	0.370	CHLORIDE (CL)	2.4	0.062
ASSIUM (K)			SULFATE (SO4)	4.0	0.083
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	0.00 (AF 1122165)	0.010
			NO3+NO2 (TOT AS N)	0.04	0.003

SUM CATIONS	60.8	3.387	SUM ANIONS	204.2	3.403
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LABORATORY PH		TOT HARDNESS(MG/L-CACO3)	151
LD WATER TEMPERATURE (C)	0.7	TOT ALKALINITY(MG/L-CACO3)	162
M-DISS. IONS MEAS.(MG/L)	265.3	LABORATORY TURBIDITY (NTU)	4.8
B CONDUCTIVITY-UMHDS-25C		SODIUM ADSORPTION RATIO	0.3

A D D I T I O N A L		P A R A M E T E R S	
IMENT,TOT,SUSP (MG/L)	< 8.1	PHOSPHOROUS,TOT (MG/L-P)	0.02
MONIA,TOTAL(MG/L AS N)	0.02	NITROGEN,KJL,TOT(MG/L-N)	0.2
PH,FIELD(SU)	8.33	OXYGEN, DISS (MG/L AS O)	11.85
0.5-DAY-20C(MG/L AS O)	<2.0	COD,LOW LEVEL(MG/L AS O)	16.1

ARKS: ASHLEY CREEK RECOVERY ABOVE AIRPORT ROAD CROSSING
EXCEED HOLDING TIME ON JTV
ES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PLE NO-01 SAMPLER-EEW HANDLING-5200 ANALYST-LAB LAB-WQBH SCAN-NO
PLETED-01/08/85 COMPUTER RUN-01/17/85 DATA-0684/PGM-0984 FUND-2053
O DEV. 10N BALANCE= 0.10 CA MG NA K CL SO4 HCO3 CO3 NO3
ES- 58.5 30.6 10.9 0.0 2.0 2.5 95.5 0.0 0.0
C. MEQ/L= SC N/A, NO CALC. 84W2206

STATE	MONTANA	COUNTY	FLATHEAD
LONG.	480955N 1141756W	SAMPLE LOCATION	28N 21W 296AD
DN CODE		ANALYSIS NUMBER	84W2210
DATE SAMPLED	11-15-84	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	0900	WATER FLOW RATE	
METHOD SAMPLED	GRAY+DEPTH TSS	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WOBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: ASHLEY CREEK BELOW KALISPELL WWTP DISCH.

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	29.9	1.492	BICARBONATE (HCO3)	183.0	2.999
MAGNESIUM (MG)	13.0	1.069	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	17.5	0.761	CHLORIDE (CL)	10.6	0.299
POTASSIUM (K)			SULFATE (SO4)	8.3	0.173
			FLUORIDE (F)		
			PHOSPHATE (PO4 AS P)	.30	0.029
			NO3+NO2 (TOT AS N)	.20	0.014

SUM CATIONS	60.4	3.323	SUM ANIONS	202.4	3.514
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LABORATORY PH		TOT HARDNESS (MG/L-CACD3)	128
WATER TEMPERATURE (C)	2.0	TOT ALKALINITY (MG/L-CACD3)	150
SS. IONS MEAS. (MG/L)	264.1	LABORATORY TURBIDITY (NTU)	8.3
CONDUCTIVITY-UMHDS-25C		SODIUM ADSORPTION RATIO	0.7

A D D I T I O N A L		P A R A M E T E R S	
SEDIMENT, TOT, SUSP (MG/L)	9.1	PHOSPHOROUS, TOT (MG/L-P)	.37
AMMONIA, TOTAL (MG/L AS N)	1.65	NITROGEN, KJL, TOT (MG/L-N)	2.1
PH, FIELD (SU)	8.23	OXYGEN, DISS (MG/L AS O)	9.30
DO, 5-DAY-20C (MG/L AS O)	2.3	COD, LOW LEVEL (MG/L AS O)	20.0

MARKS: ASHLEY CREEK RECOVERY

UPSTREAM CEMETARY ROAD CROSSING

EXCEED HOLDING TIME ON JTV

UNITS: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

PR NO-03 SAMPLER-EEW HANDLING-5200 ANALYST-WAT LAB-WOB SCAN-NO
 ED-01/04/85 COMPUTER RUN-01/17/85 DATA-0684/PGM-0984 FUND-2053
 EV. ION BALANCE= 1.20 CA MG NA K CL SO4 HCO3 CO3 NO3
 ES- 44.9 32.2 22.9 0.0 8.6 5.0 86.4 0.0 0.0
 LC. MEQ/L= SC N/A. NO CALC. 84W2210

STATE	MONTANA	COUNTY	FLATHEAD
LAT.-LONG.	480850N 1141707W	SAMPLE LOCATION	28N 21W 335CC
TATION CODE		ANALYSIS NUMBER	84W2211
DATE SAMPLED	11-15-84	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	0915	WATER FLOW RATE	
METHOD SAMPLED	GRAY+DEPTH TSS	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: ASHLEY CREEK AT HWY 93 CROSSING

	MG/L	MEQ/L		MG/L	MEQ/L
ALCIUM (CA)	41.4	2.066	BICARBONATE(HCO3)	214.7	3.519
MAGNESIUM (MG)	14.5	1.193	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	20.1	0.874	CHLORIDE (CL)	11.3	0.319
POTASSIUM (K)			SULFATE (SO4)	8.8	0.183
			FLUORIDE (F)		
			PHOSPHATE(P04 AS P)	0.92	0.089
			NO3+NO2 (TOT AS N)	0.93	0.066

SUM CATIONS	<u>76.0</u>	<u>4.133</u>	SUM ANIONS	<u>236.7</u>	<u>4.176</u>
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LABORATORY PH		TOT HARDNESS(MG/L-CAC03)	163
WATER TEMPERATURE (C)	2.0	TOT ALKALINITY(MG/L-CAC03)	176
DISS. IONS MEAS.(MG/L)	317.8	LABORATORY TURBIDITY (NTU)	7.6
CONDUCTIVITY-UMHOS-25C		SODIUM ADSORPTION RATIO	0.7

A D D I T I O N A L		P A R A M E T E R S	
DIMENT, TOT, SUSP (MG/L)	10.6	PHOSPHOROUS, TOT (MG/L-P)	0.94
AMONIA, TOTAL(MG/L AS N)	1.03	NITROGEN, KJL, TOT(MG/L-N)	1.5
PH, FIELD(SU)	8.20	OXYGEN, DISS (MG/L AS O)	8.30
D, 5-DAY-20C(MG/L AS O)	<2.0	COD, LGW LEVEL(MG/L AS O)	22.9

MARKS: ASHLEY CREEK RECOVERY

DUPLICATE D.C. 8.40

EXCEED HOLDING TIME ON JTV

ES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

 PLE NO-04 SAMPLER-EEW HANDLING-5200 ANALYST-LAB LAB-WQBH SCAN-NO
 PLETED-01/04/85 COMPUTER RUN-01/17/85 DATA-0684/PGM-0984 FUND-2053
 D DEV. ION BALANCE= 0.25 CA MG NA K CL SO4 HCO3 CO3 NO3
 ES- 50.0 28.9 21.2 0.0 7.9 4.5 87.5 0.0 0.0
 C. MEQ/L= SC N/A, NO CALC. 84W2211

TE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA

STATE MONTANA
 .-LONG. 480850N 1141256W
 TATION CODE
 DATE SAMPLED 11-15-84
 TIME SAMPLED 0945
 METHOD SAMPLED GRAB
 SAMPLE SOURCE STREAM
 WATER USE MULTIPLE
 AQUIFER(S)
 SAMPLED BY WQBH

COUNTY FLATHEAD
 SAMPLE LOCATION 28N 21W 368D
 ANALYSIS NUMBER 84W2212
 DRAINAGE BASIN 76LJ -U.FLTHD R.
 WATER FLOW RATE
 FLOW MEASUREMENT METHOD
 ALTITUDE OF LAND SURFACE
 TOTAL WELL DEPTH BELOW LS
 SWL ABOVE(+) OR BELOW LS
 SAMPLE DEPTH BELOW SURFACE

SAMPLING SITE: ASHLEY CREEK NEAR MOUTH ON FLATHEAD RIVER

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	43.1	2.151	BICARBONATE(HCO3)	224.5	3.679
MAGNESIUM (MG)	15.3	1.259	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	22.9	0.996	CHLORIDE (CL)	13.0	0.367
POTASSIUM (K)			SULFATE (SO4)	10.3	0.214
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	0.42	0.041
			NO3+NO2 (TOT AS N)	0.92	0.066

SUM CATIONS	81.3	4.405	SUM ANIONS	249.1	4.366
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LABORATORY PH		TOT HARDNESS(MG/L-CACD3)	171
WATER TEMPERATURE (C)	2.3	TOT ALKALINITY(MG/L-CACD3)	184
TOTAL DISS. IONS MEAS.(MG/L)	334.4	LABORATORY TURBIDITY (NTU)	7.4
LAB CONDUCTIVITY-UMHOS-25C		SODIUM ADSORPTION RATIO	0.8

A D D I T I O N A L		P A R A M E T E R S	
PHOSPHOROUS, TOT (MG/L-P)	0.42	AMMONIA, TOTAL(MG/L AS N)	0.82
NITROGEN, KJL, TOT(MG/L-N)	1.3	PH, FIELD(SU)	8.22
OXYGEN, DISS (MG/L AS O)	9.85	BOD, 5-DAY-20C(MG/L AS O)	2.4
BOD, LOW LEVEL(MG/L AS O)	20.9	Sediment, tot., susp. (mg/L)	9.2

1/22/85
 CAF

MARKS: ASHLEY CREEK RECOVERY

AT COUNTY ROAD 1 MILE ABOVE MOUTH

EXCEED HOLDING TIME ON JTV

TESTS: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 - CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 =TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

NO-05 SAMPLER-EEW HANDLING-5200 ANALYST-LAB LAB-WQBH SCAN-NO
 COMPLETED-01/08/85 COMPUTER RUN-01/17/85 DATA-0684/PGM-0984 FUND-2053
 NO DEV. ION BALANCE=-0.22 CA MG NA K CL SO4 HCO3 CO3 NO3
 DES- 48.8 28.6 22.6 0.0 8.6 5.0 86.4 0.0 0.0
 C. MEQ/L= SCN/A, NO CALC. 84W2212

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59526

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 09/02/94 TIME: 08:55 BY: DRM
LATITUDE: 481034N
LONGITUDE: 1141834W

SAMPLE ID: ASHLEY CR ABV KAL WWTP 01
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 19ADD
SITE DESCRIPTION:

EMP:19.8 C/F: C FLOW: 4.0 UNITS: CFS METHOD: ESTIMATED CONDUCTIVITY: 0.315

8.02 STAFF GUAGE HT: DISSOLVED O2: MG/L TURBIDITY: 13.00 NTU

FIELD COMMENTS: WATER USAGE: <----->
STREAM TURBID; FLOW SLUGGISH

CHEM LAB SAMPLE REPORT

September 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9409-106190	ALK	08/29/94	1420 LOREN B.		174	MG/L
	CA	08/29/94	1420 LOREN B.		18	MG/L
	CL	08/29/94	1420 LOREN B.		3.1	MG/L
	CO3	08/29/94	1420 LOREN B.		148	MG/L
	GRAINS	08/29/94	1420 LOREN B.		13.6	G/PG
	HARD	08/29/94	1420 LOREN B.		233	MG/L
	HCO3	08/29/94	1420 LOREN B.		< 1	MG/L
	MG	08/29/94	1420 LOREN B.		45.6	MG/L
	NA	08/29/94	1420 LOREN B.		6.9	MG/L
	NH3	08/29/94	1420 LOREN B.		0.026	MG/L
	NO3	08/29/94	1420 LOREN B.		0.01	MG/L
	OP	08/29/94	1420 LOREN B.		0.018	MG/L
	PH	08/29/94	1420 LOREN B.		8.32	UNITS
	SO4	08/29/94	1420 LOREN B.		7.1	MG/L
	SPC	08/29/94	1420 LOREN B.		407	UMHOS
	TDS	08/29/94	1420 LOREN B.		171	MG/L
	TKN	08/29/94	1420 LOREN B.		0.8	MG/L

APPROVED BY:

DLB

**FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

September 22, 1994

test#	testid	collect date	collect time by	collect method agency	reported	units
9409-106190	TP	08/29/94	1420 LOREN B.		0.034	MG/L
	TSS	08/29/94	1420 LOREN B.		8.3	MG/L
	TURB	08/29/94	1420 LOREN B.		7	FTU

ant 20

APPROVED BY:

DJB

***FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59526

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 09/02/94 TIME: 08:55 BY: DRM
LATITUDE: 480955N
LONGITUDE: 1141756W

SAMPLE ID: ASHLEY CR BLW KAL WWTP 03
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 29BAD
SITE DESCRIPTION:

TEMP: 20.3 C/F: C FLOW: 6.0 UNITS: CFS METHOD: ESTIMATED CONDUCTIVITY: 0.508

7.94 STAFF GAUGE HT: DISSOLVED O2: MG/L TURBIDITY: 15.00 NTU

FIELD COMMENTS: WATER USAGE: <----->
SAMPLES COLLECTED ON DOWNSTREAM SIDE OF ROAD BLW CULVERT.

CHEM LAB SAMPLE REPORT

September 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9409-106191	ALK	08/29/94	1515 LOREN B.		190	MG/L
	CA	08/29/94	1515 LOREN B.		19.4	MG/L
	CL	08/29/94	1515 LOREN B.		43.8	MG/L
	CO3	08/29/94	1515 LOREN B.		134	MG/L
	GRAINS	08/29/94	1515 LOREN B.		14.1	G/PG
	HARD	08/29/94	1515 LOREN B.		240	MG/L
	HCO3	08/29/94	1515 LOREN B.		< 1	MG/L
	MG	08/29/94	1515 LOREN B.		46.6	MG/L
	NA	08/29/94	1515 LOREN B.		42.6	MG/L
	NH3	08/29/94	1515 LOREN B.		0.05	MG/L
	NO3	08/29/94	1515 LOREN B.		0.83	MG/L
	OP	08/29/94	1515 LOREN B.		0.042	MG/L
	PH	08/29/94	1515 LOREN B.		8.33	UNITS
	SO4	08/29/94	1515 LOREN B.		9.6	MG/L
	SPC	08/29/94	1515 LOREN B.		542	UMHOS
	TDS	08/29/94	1515 LOREN B.		288	MG/L
	TKN	08/29/94	1515 LOREN B.		0.9	MG/L

APPROVED BY:

DLB

**FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

September 22, 1994

#	testid	collect date	collect time by	collect method agency	reported	units
09-106191	TP	08/29/94	1515 LOREN B.		0.068	MG/L
	TSS	08/29/94	1515 LOREN B.		19.1	MG/L
	TURB	08/29/94	1515 LOREN B.		12	FTU

unt 20

PROVED BY:

DLB

FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59526

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

LOGIN DATE: 09/02/94 TIME: 08:55 BY: DRM
LATITUDE: 480850N
LONGITUDE: 1141707W

SAMPLE ID: A. CR @ HWY 93 S OF K 04
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 33BCC
SITE DESCRIPTION: BREAKING OFF BOTTOMS FLOATING TO SURFACE AND CARRIED DOWN S.

EMP:19.3 C/F: C FLOW: 5.0 UNITS: CFS METHOD: ESTIMATED CONDUCTIVITY: 0.516

H: 8.06 STAFF GUAGE HT: DISSOLVED O2: MG/L TURBIDITY: 11.00 NTU

FIELD COMMENTS: WATER USAGE: <----->
PUMP COLLECTED ON UPSTREAM SIDE OF HWY; GOBS OF BLACK ALGAE

CHEM LAB SAMPLE REPORT

September 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9409-106192	ALK	08/29/94	1545 LOREN B.		192	MG/L
	CA	08/29/94	1545 LOREN B.		19.8	MG/L
	CL	08/29/94	1545 LOREN B.		48.7	MG/L
	CO3	08/29/94	1545 LOREN B.		136	MG/L
	GRAINS	08/29/94	1545 LOREN B.		14.0	G/PG
	HARD	08/29/94	1545 LOREN B.		239	MG/L
	HCO3	08/29/94	1545 LOREN B.		< 1	MG/L
	MG	08/29/94	1545 LOREN B.		46	MG/L
	NA	08/29/94	1545 LOREN B.		47.4	MG/L
	NH3	08/29/94	1545 LOREN B.		0.05	MG/L
	NO3	08/29/94	1545 LOREN B.		0.69	MG/L
	OP	08/29/94	1545 LOREN B.		0.025	MG/L
	PH	08/29/94	1545 LOREN B.		8.35	UNITS
	SO4	08/29/94	1545 LOREN B.		10.2	MG/L
	SPC	08/29/94	1545 LOREN B.		560	UMHOS
	TDS	08/29/94	1545 LOREN B.		280	MG/L
	TKN	08/29/94	1545 LOREN B.		0.9	MG/L

APPROVED BY: DLB
***FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

September 22, 1994

lab#		collect testid date	collect time by	collect method agency	reported	units
9409-106192	TP	08/29/94	1545 LOREN B.		0.056	MG/L
	TSS	08/29/94	1545 LOREN B.		5.8	MG/L
	TURB	08/29/94	1545 LOREN B.		3	FTU

ount 20

PROVED BY: DLB

*FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59526

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 09/02/94 TIME: 08:55 BY: DRM
LATITUDE: 480850N
LONGITUDE: 1141256W

SAMPLE ID: A. CR NR MOUTH @ FLAT 05
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 36BDC
SITE DESCRIPTION: ITH FILAMENTAINS ALGAE GROWING OUT FOR 10-15 FT FROM EITHE S.

EMP:21.5 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.383
H: 8.60 STAFF GUAGE HT: DISSOLVED O2: MG/L TURBIDITY: 2.00 NTU

FIELD COMMENTS: WATER USAGE: <----->
T ABOUT 30 YD WIDE NO DESCERNABLE FLOW; RESEMBLES A LOGOON W

CHEM LAB SAMPLE REPORT

September 22, 1994

ab#	testid	collect date	collect time by	collect method agency	reported	units
9409-106193	ALK	08/29/94	1645 LOREN B.		150	MG/L
	CA	08/29/94	1645 LOREN B.		16.9	MG/L
	CL	08/29/94	1645 LOREN B.		40.4	MG/L
	CO3	08/29/94	1645 LOREN B.		80	MG/L
	GRAINS	08/29/94	1645 LOREN B.		9.3	G/PG
	HARD	08/29/94	1645 LOREN B.		158	MG/L
	HCO3	08/29/94	1645 LOREN B.		< 1	MG/L
	MG	08/29/94	1645 LOREN B.		28.2	MG/L
	NA	08/29/94	1645 LOREN B.		42.2	MG/L
	NH3	08/29/94	1645 LOREN B.		< 0.01	MG/L
	NO3	08/29/94	1645 LOREN B.		< 0.01	MG/L
	OP	08/29/94	1645 LOREN B.		0.007	MG/L
	PH	08/29/94	1645 LOREN B.		8.65	UNITS
	SO4	08/29/94	1645 LOREN B.		9.9	MG/L
	SPC	08/29/94	1645 LOREN B.		450	UMHOS
	TDS	08/29/94	1645 LOREN B.		209	MG/L
	TKN	08/29/94	1645 LOREN B.		0.7	MG/L

APPROVED BY:

DLB

***FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

September 22, 1994

b#	testid	collect date	collect time by	collect method agency	reported	units
9409-106193	TP	08/29/94	1645 LOREN B.		0.035	MG/L
	TSS	08/29/94	1645 LOREN B.		3.3	MG/L
	TURB	08/29/94	1645 LOREN B.		3	FTU

unt 20

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DLB

**FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 12/02/94 TIME: 10:12 BY: DRM
LATITUDE: 481034N
LONGITUDE: 1141834W

SAMPLE ID: AC01 ASH CR ABV KAL WWTP
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 19ADD
SITE DESCRIPTION:

EMP:0 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.396
I: 8.16 STAFF GUAGE HT: DISSOLVED O2: 10.66 MG/L TURBIDITY: 2.00 NTU

IELD COMMENTS: WATER USAGE: <----->
TREAM MOSTLY ICE COVERED.

CHEM LAB SAMPLE REPORT

December 22, 1

ab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107469	ALK	11/29/94	0930 L. BAHLS		186	MG/L
	CA	11/29/94	0930 L. BAHLS		49.7	MG/L
	CL	11/29/94	0930 L. BAHLS		5.6	MG/L
	CO3	11/29/94	0930 L. BAHLS		178	MG/L
	GRAINS	11/29/94	0930 L. BAHLS		11.0	G/PG
	HARD	11/29/94	0930 L. BAHLS		187	MG/L
	HCO3	11/29/94	0930 L. BAHLS		8	MG/L
	MG	11/29/94	0930 L. BAHLS		15.3	MG/L
	NA	11/29/94	0930 L. BAHLS		7.2	MG/L
	NH3	11/29/94	0930 L. BAHLS		0.02	MG/L
	NO3	11/29/94	0930 L. BAHLS		0.13	MG/L
	OP	11/29/94	0930 L. BAHLS		0.004	MG/L
	PH	11/29/94	0930 L. BAHLS		8.13	UNITS
	SO4	11/29/94	0930 L. BAHLS		6.8	MG/L
	SPC	11/29/94	0930 L. BAHLS		369	UMHOS
	TDS	11/29/94	0930 L. BAHLS		203	MG/L
	TKN	11/29/94	0930 L. BAHLS		0.3	MG/L

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December 22, 1994

ab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107469	TP	11/29/94	0930 L. BAHLS		0.018	MG/L
	TSS	11/29/94	0930 L. BAHLS		2.2	MG/L
	TURB	11/29/94	0930 L. BAHLS		2	FTU

ount 20

APPROVED BY:

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**FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 12/02/94 TIME: 10:12 BY: DRM
LATITUDE: 480955N
LONGITUDE: 1141756W

SAMPLE ID: AC03 ASH BLW KAL WWTP
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 29BAD
SITE DESCRIPTION:

EMP:1.5 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.509

H: 8.30 STAFF GUAGE HT: DISSOLVED O2: 10.54 MG/L TURBIDITY: 7.00 NTU

IELD COMMENTS: WATER USAGE: <----->
TREAM ICE-FREE

CHEM LAB SAMPLE REPORT

December 22, 1994

ab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107470	ALK	11/29/94	1005 L. BAHLS		195	MG/L
	CA	11/29/94	1005 L. BAHLS		50.9	MG/L
	CL	11/29/94	1005 L. BAHLS		34.6	MG/L
	CO3	11/29/94	1005 L. BAHLS		134	MG/L
	GRAINS	11/29/94	1005 L. BAHLS		11.4	G/PG
	HARD	11/29/94	1005 L. BAHLS		196	MG/L
	HCO3	11/29/94	1005 L. BAHLS		61	MG/L
	MG	11/29/94	1005 L. BAHLS		16.6	MG/L
	NA	11/29/94	1005 L. BAHLS		34.2	MG/L
	NH3	11/29/94	1005 L. BAHLS		0.04	MG/L
	NO3	11/29/94	1005 L. BAHLS		1.13	MG/L
	OP	11/29/94	1005 L. BAHLS		0.019	MG/L
	PH	11/29/94	1005 L. BAHLS		8.05	UNITS
	SO4	11/29/94	1005 L. BAHLS		10.7	MG/L
	SPC	11/29/94	1005 L. BAHLS		506	UMHOS
	TDS	11/29/94	1005 L. BAHLS		256	MG/L
	TKN	11/29/94	1005 L. BAHLS		0.7	MG/L

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December 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107470	TP	11/29/94	1005 L. BAHLS		0.041	MG/L
	TSS	11/29/94	1005 L. BAHLS		11.1	MG/L
	TURB	11/29/94	1005 L. BAHLS		4	FTU

ount 20

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STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

BEGIN DATE: 12/02/94 TIME: 10:12 BY: DRM SAMPLE ID: AC04 ASH CR AT HWY 93
LATITUDE: 480850N STORET ID:
LONGITUDE: 1141707W LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 33BCC
SITE DESCRIPTION:

TEMP: 0.4 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.466

8.48 STAFF GAUGE HT: DISSOLVED O2: 11.97 MG/L TURBIDITY: 10.00 NTU

FIELD COMMENTS: WATER USAGE: <----->
PARTLY ICE COVERED.

CHEM LAB SAMPLE REPORT

December 22, 1994

Lab#	testid	collect date	collect time by	collect method agency	reported	units
0412-107471	ALK	11/29/94	1045 L. BAHLS		196	MG/L
	CA	11/29/94	1045 L. BAHLS		50.7	MG/L
	CL	11/29/94	1045 L. BAHLS		34.6	MG/L
	CO3	11/29/94	1045 L. BAHLS		152	MG/L
	GRAINS	11/29/94	1045 L. BAHLS		11.5	G/PG
	HARD	11/29/94	1045 L. BAHLS		197	MG/L
	HCO3	11/29/94	1045 L. BAHLS		44	MG/L
	MG	11/29/94	1045 L. BAHLS		17	MG/L
	NA	11/29/94	1045 L. BAHLS		33.9	MG/L
	NH3	11/29/94	1045 L. BAHLS		0.06	MG/L
	NO3	11/29/94	1045 L. BAHLS		1.09	MG/L
	OP	11/29/94	1045 L. BAHLS		0.02	MG/L
	PH	11/29/94	1045 L. BAHLS		8.16	UNITS.
	SO4	11/29/94	1045 L. BAHLS		11	MG/L
	SPC	11/29/94	1045 L. BAHLS		516	UMHOS
	TDS	11/29/94	1045 L. BAHLS		280	MG/L
	TKN	11/29/94	1045 L. BAHLS		0.7	MG/L

APPROVED BY: DLB

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December 22, 1994

ab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107471	TP	11/29/94	1045 L. BAHLS		0.039	MG/L
	TSS	11/29/94	1045 L. BAHLS		9.5	MG/L
	TURB	11/29/94	1045 L. BAHLS		4	FTU

ount 20

APPROVED BY: DLB

***FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

Appendix B. Water quality results for East Spring Creek on
August 31, 1994.

Site	Temperature (C)	pH	Specific Conductance (μ mhos/cm)
Below Farrier's Dam (SC01)	19.1	8.74	268
Trumbull Creek (SC02)	14.7	8.60	393
Granite View (SC03)	12.5	8.00	415
Highway 35	11.3	8.13	405

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 12/02/94 TIME: 10:53 BY: DRM
LATITUDE: 48DEG 28' N
LONGITUDE: 114DEG 30' W

SAMPLE ID: SR01 STILLWATER R BLW LK
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 31N 23W 10AC
SITE DESCRIPTION:

EMP:2 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.235

8.12 STAFF GUAGE HT: DISSOLVED O2: 12.35 MG/L TURBIDITY: 35.00 NTU

FIELD COMMENTS: WATER USAGE: <----->
HELF ICE; MUDDY BOTTOM

CHEM LAB SAMPLE REPORT

December 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107475	CL	11/29/94	1030 L. BAH		1.0	MG/L
	NH3	11/29/94	1030 L. BAH		< 0.01	MG/L
	NO3	11/29/94	1030 L. BAH		0.03	MG/L
	OP	11/29/94	1030 L. BAH		0.001	MG/L
	PH	11/29/94	1030 L. BAH		8.11	UNITS
	SPC	11/29/94	1030 L. BAH		259	UMHOS
	TKN	11/29/94	1030 L. BAH		0.1	MG/L
	TP	11/29/94	1030 L. BAH		0.004	MG/L
	TURB	11/29/94	1030 L. BAH		1	FTU

ount 9

11/30/94
LB

APPROVED BY:

DLB

**FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHL
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

LOGIN DATE: 12/02/94 TIME: 10:53 BY: DRM
LATITUDE: 48DEG 13'N
LONGITUDE: 114DEG 18'W

SAMPLE ID: SR02 STILLWATER R NR MOUT
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 08BB
SITE DESCRIPTION:

TEMP: 0.9 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.261
pH: 8.44 STAFF GAUGE HT: DISSOLVED O2: 12.48 MG/L TURBIDITY: 25.00 NTU
FIELD COMMENTS: WATER USAGE: <----->
SITE BELOW 2FT WATERFALL

CHEM LAB SAMPLE REPORT

December 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107476	CL	11/29/94	1200 L. BAHL		1.3	MG/L
	NH3	11/29/94	1200 L. BAHL		0.01	MG/L
	NO3	11/29/94	1200 L. BAHL		0.18	MG/L
	OP	11/29/94	1200 L. BAHL		0.003	MG/L
	PH	11/29/94	1200 L. BAHL		8.02	UNITS
	SPC	11/29/94	1200 L. BAHL		285	UMHOS
	TKN	11/29/94	1200 L. BAHL		0.1	MG/L
	TP	11/29/94	1200 L. BAHL		0.007	MG/L
	TURB	11/29/94	1200 L. BAHL		1	FTU

ount 9

11/30/94
LB

APPROVED BY: DLB
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STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHL
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

LOGIN DATE: 12/02/94 TIME: 10:53 BY: DRM SAMPLE ID: WR02 WHITE R AT HWY 40 BR
LATITUDE: 482212N STORET ID:
LONGITUDE: 1141804W LEGAL DESCRIPTION:

LEGAL TEXT: 30N 21W 16BBA
SITE DESCRIPTION:

TEMP: 2.8 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.195
PH: 8.42 STAFF GAUGE HT: DISSOLVED O2: 11.33 MG/L TURBIDITY: 7.00 NTU
FIELD COMMENTS: WATER USAGE: <----->
RIVER ICE FREE

CHEM LAB SAMPLE REPORT

December 22, 1994

lab#	testid	collect date	collect time by	collect method agency	reported	units
9412-107473	CL	11/29/94	1430 L. BAHL		2.3	MG/L
	NH3	11/29/94	1430 L. BAHL		0.21	MG/L
	NO3	11/29/94	1430 L. BAHL		0.14	MG/L
	OP	11/29/94	1430 L. BAHL		0.006	MG/L
	PH	11/29/94	1430 L. BAHL		8.05	UNITS
	SPC	11/29/94	1430 L. BAHL		207	UMHOS
	TKN	11/29/94	1430 L. BAHL		0.4	MG/L
	TP	11/29/94	1430 L. BAHL		0.013	MG/L
	TURB	11/29/94	1430 L. BAHL		2	FTU

ount 9

APPROVED BY: DLB
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STATE OF MONTANA
DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES
COGSWELL BUILDING
HELENA MONTANA, 59620-0901

LABORATORY SYSTEM

ACCOUNT: WQ4EMS04 ATTN: LOREN BAHLS
RC NR: 59539

DHES WATER QUALITY BUREAU EMS04
COGSWELL BUILDING ROOM A-206
HELENA MT 596200000

OGIN DATE: 12/02/94 TIME: 10:53 BY: DRM
LATITUDE: 481301N
LONGITUDE: 1141703W

SAMPLE ID: WR03 WHITE R NR MOUTH
STORET ID:
LEGAL DESCRIPTION:

LEGAL TEXT: 28N 21W 04CB
SITE DESCRIPTION:

EMP:2.3 C/F: C FLOW: UNITS: METHOD: CONDUCTIVITY: 0.262

H: 8.23 STAFF GUAGE HT: DISSOLVED O2: 11.79 MG/L TURBIDITY: 12.00 NTU

IELD COMMENTS: WATER USAGE: <----->
IVER ICE FREE

CHEM LAB SAMPLE REPORT

December 22, 1

ab#	collect testid date	collect time by	collect method agency	reported	units
9412-107474	CL 11/29/94	1530 L. BAHL		5.1	MG/L
	NH3 11/29/94	1530 L. BAHL		0.07	MG/L
	NO3 11/29/94	1530 L. BAHL		0.52	MG/L
	OP 11/29/94	1530 L. BAHL		0.003	MG/L
	PH 11/29/94	1530 L. BAHL		7.94	UNITS
	SPC 11/29/94	1530 L. BAHL		286	UMHOS
	TKN 11/29/94	1530 L. BAHL		0.2	MG/L
	TP 11/29/94	1530 L. BAHL		0.008	MG/L
	TURB 11/29/94	1530 L. BAHL		1	FTU

ount 9

PROVED BY: DLB

FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342

STATE	MONTANA	COUNTY	FLATHEAD
T.-LONG.	481301N 1141703W	SAMPLE LOCATION	28N 21W 04CB
ION CODE	03	ANALYSIS NUMBER	92W3128
DATE SAMPLED	11-17-92	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	1130	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	2920. FT
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: WHITEFISH RIVER NEAR MOUTH *along river-flood*

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)			BICARBONATE(HCO3)		
MAGNESIUM (MG)			CARBONATE (CO3)		
SODIUM (NA)			CHLORIDE (CL)	2.3 ✓	0.065
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	.002 ✓	0.000
			NO3+NO2 (TOT AS N)	.26 ✓	0.019
SUM CATIONS	0.0	0.000	SUM ANIONS	2.6	0.084

LABORATORY PH	8.15 ✓	TOT HARDNESS(MG/L-CACO3)	
WATER TEMPERATURE (C)	5.1	TOT ALKALINITY(MG/L-CACO3)	
DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	257 ✓	SODIUM ADSORPTION RATIO	

A D D I T I O N A L		P A R A M E T E R S	
PHOSPHOROUS,TOT (MG/L-P)	.004 ✓	AMMONIA,TOTAL(MG/L AS N)	< .01 ✓
NITROGEN,KJL,TOT(MG/L-N)	.2 ✓	PH, FIELD(SU)	7.76
CONDUCTVY, FIELD MICROMHOS	256	OXYGEN, DISS (MG/L AS O)	13.20
TURBIDITY ,FIELD (NTU)	1		

REMARKS: WHITEFISH RIVER

SAMPLING POINT ON EAST BANK NEXT TO

BLACKTOP RIVER ~~SEE~~ ROAD

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 R=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

LAB NO-03 SAMPLER-LLB HANDLING-2101 ANALYST-LAB LAB- SCAN-NO
 DATED-12/07/92 COMPUTER RUN-12/15/92 DATA-0684/PGM-0984 FUND-2521
 TAD DEV. ION BALANCE= CA MG NA K CL SO4 HCO3 CO3 NO3
 PDES- 0.0 0.0 0.0 0.0100.0 0.0 0.0 0.0 0.0
 ALC. MEQ/L= 2.503 TO 2.767 92W3128

LABORATORY SYSTEM

****FOR QUESTIONS CONCERNING THIS ANALYSIS CALL: 406-444-5342**

STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	FLATHEAD
STATION NO.	482458N 1142054W	SAMPLE LOCATION	31N 22W 25CC
ION CODE	01	ANALYSIS NUMBER	92W3129
DATE SAMPLED	11-17-92	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	0900	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	2995. FT
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: WHITEFISH RIVER AT LAKE OUTLET

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)			BICARBONATE(HCO3)		
MAGNESIUM (MG)			CARBONATE (CO3)		
SODIUM (NA)			CHLORIDE (CL)	< 1 ✓	0.028
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	<.001 ✓	0.000
			NO3+NO2 (TOT AS N)	<.01 ✓	0.001
SUM CATIONS	0.0	0.000	SUM ANIONS	1.0	0.029

LABORATORY PH	8.27 ✓	TOT HARDNESS(MG/L-CAC03)	
WATER TEMPERATURE (C)	6.7	TOT ALKALINITY(MG/L-CAC03)	
DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB. CONDUCTIVITY-UMHOS-25C	177 ✓	SODIUM ADSORPTION RATIO	

A D D I T I O N A L		P A R A M E T E R S	
PHOSPHOROUS,TOT (MG/L-P)	.002 ✓	AMMONIA,TOTAL(MG/L AS N)	< .01 ✓
NITROGEN,KJL,TOT(MG/L-N)	.2 ✓	PH, FIELD(SU)	8.15
CONDUCTIVITY, FIELD MICROMHOS	178	OXYGEN, DISS (MG/L AS O)	11.62
TURBIDITY ,FIELD (NTU)	0		

REMARKS: WHITEFISH RIVER

SAMPLING POINT ON EAST BANK 100 YARD

S ABOVE RR TRESTLE

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

LAB NO-01 SAMPLER-LLB HANDLING-2101 ANALYST-LAB LAB- SCAN-NO
 DATE-12/07/92 COMPUTER RUN-12/15/92 DATA-0684/PGM-0984 FUND-2521
 DEV. ION BALANCE= CA MG NA K CL SO4 HCO3 CO3 NO3
 PDES- 0.0 0.0 0.0 0.0100.0 0.0 0.0 0.0 0.0
 CALC. MEQ/L= 1.696 TO 1.875 92W3129

STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	FLATHEAD
LAT.-LONG.	482212N 1141804W	SAMPLE LOCATION	30N 21W 1688A
STATION CODE	02	ANALYSIS NUMBER	92W3127
DATE SAMPLED	11-17-92	DRAINAGE BASIN	76LJ -U.FLTHD R.
TIME SAMPLED	1000	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE	STREAM	ALTITUDE OF LAND SURFACE	2990. FT
WATER USE	MULTIPLE	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: WHITEFISH RIVER AT HIGHWAY 40 BRIDGE

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)			BICARBONATE(HCO3)		
MAGNESIUM (MG)			CARBONATE (CO3)		
SODIUM (NA)			CHLORIDE (CL)	< 1 ✓	0.028
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)		
			PHOSPHATE(PO4 AS P)	.007 ✓	0.001
			NO3+NO2 (TOT AS N)	.09 ✓	0.006
SUM CATIONS	0.0	0.000	SUM ANIONS	1.1	0.035

LABORATORY PH	8.07 ✓	TOT HARDNESS(MG/L-CACO3)	
FIELD WATER TEMPERATURE (C)	5.5	TOT ALKALINITY(MG/L-CACO3)	
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	196 ✓	SODIUM ADSORPTION RATIO	

A D D I T I O N A L		P A R A M E T E R S	
PHOSPHOROUS,TOT (MG/L-P)	.009 ✓	AMMONIA,TOTAL(MG/L AS N)	.04 ✓
NITROGEN,KJL,TOT(MG/L-N)	.3 ✓	PH, FIELD(SU)	7.85
CONDUCTVY, FIELD MICROMHOS	196	OXYGEN, DISS (MG/L AS O)	12.45
TURBIDITY , FIELD (NTU)	0		

REMARKS: WHITEFISH RIVER
BRIDGE

SAMPLING POINT ON EAST BANK BELOW

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 R=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

 SAMPLE NO-02 SAMPLER-LLB HANDLING-2101 ANALYST-LAB LAB- SCAN-NO
 COMPLETED-12/07/92 COMPUTER RUN-12/15/92 DATA-0684/PGM-0984 FUND-2521
 END DEV. ION BALANCE= CA MG NA K CL SO4 HCO3 CO3 NO3
 PDES- 0.0 0.0 0.0 0.0100.0 0.0 0.0 0.0 0.0
 ALC. MEQ/L= 1.887 TO 2.085 92W3127